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FOREST INSECT CONDITIONS IN THE UNITED STATES 1964

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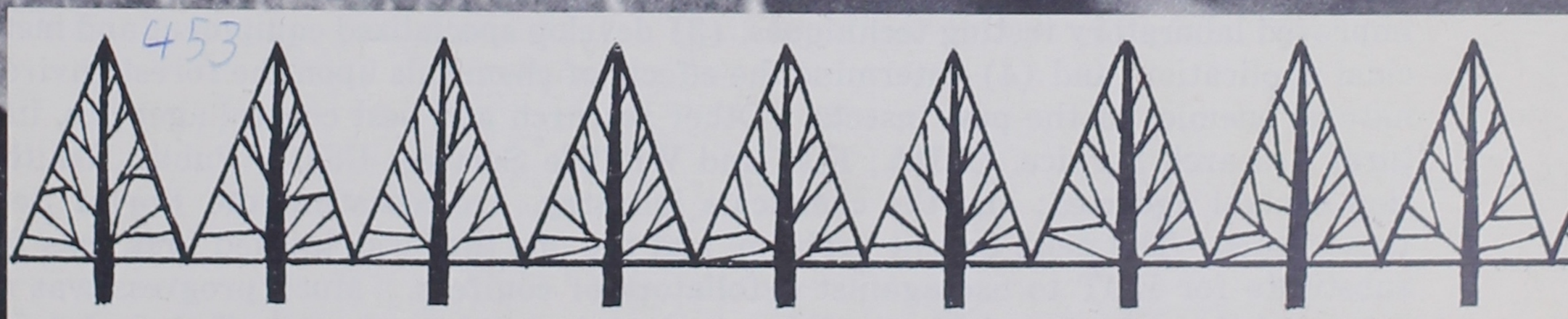

• FOREST SERVICE • U.S. DEPARTMENT OF AGRICULTURE

Foreword

This publication marks the 15th consecutive year in which the status of the more important forest insects in the United States has been surveyed and summarized. In the years since the first compilation was issued, the report has become of interest to a large and diversified audience. Some readers need only a capsule description of the overall situation; others are interested mainly in conditions regionally. Most, however, concern themselves with the national status of the pest species and with the scope, severity, and location of reported outbreaks in relation to those of prior years.

The report is based on information gathered by all Federal, State, and private agencies participating in survey operations and summarizes the more important programs undertaken for prevention and suppression. Its format reflects efforts to satisfy the interests of all readers. The sections describing the status of insects separately by forest region include a brief summary of regional conditions and follow a section that highlights the more important situations nationally.

The past year was a troublesome one for the Federal and State agencies responsible for protecting forest resources from the ravages of destructive insects. It was troublesome not only because of many large-scale and virulent outbreaks throughout the country, but also because of continued public concern about the use of persistent pesticides in some control operations. The latter problem brought major realinements in on-going programs for control of most forest defoliators. In some cases, damaging infestations were allowed to run their normal courses unattended. In others, control programs were implemented with nonpersistent insecticides of less effectiveness. Also, major revision was made in control practices to reduce or eliminate the adverse side effects of spraying. Such revision included no-spray strips of land along important rivers, streams, bird-nesting sites, and other locations; reduced spray dosages adjacent to the no-spray strips; and intensive supervision of project operations to preclude accidental dumping, misplacement, and overdosage. Fourteen percent of all spraying was done by helicopter to minimize insecticidal drift. To determine the effectiveness of precautions and safeguards, samples of fish, wildlife, and water were analyzed before, during, and after spraying to ascertain amounts and effects of residues present.

A comprehensive investigation of nonpersistent pesticides suitable for controlling destructive forest insects was begun early in 1964 with establishment of a new research and development unit at the Forest Service experiment station in Berkeley, Calif., to (1) screen the effectiveness of new materials and compounds developed by the chemicals industry, (2) develop new and improved laboratory testing techniques, (3) develop specialized equipment and methods for insecticidal application, and (4) determine the effects of chemicals upon the forest environment and upon natural enemies of the pest insects. Other research and pest control agencies, including Agricultural Research Service, USDA; Fish and Wildlife Service, USDI; Public Health Service; pollution control agencies; and the chemicals industry, are assisting the Forest Service to achieve these goals. The most urgent problem, and the one that was tackled first, was finding a suitable substitute for DDT to use against defoliators of conifers. Much progress was made during the year, and the most promising candidate materials will be operationally tested during 1965.

The consensus among leading insect taxonomists in the United States was to adopt Dr. Stephen L. Wood's 1963 revision of the genus *Dendroctonus* (Coleoptera: Scolytidae) (*The Great Basin Naturalist* 23: 1–117, illus.) and Dr. G. R. Hopping's 1964 revision of the North American species

in groups IV and V of Ips De Geer (Coleoptera: Scolytidae) (*The Canadian Entomologist* 96: 970–978, illus.). Accordingly, names assigned to the now-valid species are used in this report. For the convenience of the reader, rescinded names are carried in parentheses. However, accepted common names for all species have been retained, resulting occasionally in the use of more than one common name for a single species. Common names for the bark beetles are under study by the Common Names Committee, Entomological Society of America.

Mention of commercial products and named insecticides does not imply endorsement by the U.S. Department of Agriculture, Forest Service. The Forest Service also warns that all pesticides are poisonous to humans, fish, and wildlife; that the directions and precautions governing their use should be closely followed; and that overdosing is dangerous. Special care should be taken in applying pesticides along the edges of rivers and streams, around ponds and lakes, and in grazing and foraging areas.

Grateful acknowledgment is made to all those Federal, State, county, and private agencies whose assistance and cooperation made this report possible. Comments on the report are welcome.

J. W. BONGBERG, *Chief*
Forest Insect and Disease Surveys
Forest Service
U.S. Department of Agriculture
Washington, D.C. 20250

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Issued June 1965

FOREST INSECT CONDITIONS IN THE UNITED STATES, 1964

Highlights

Forest insect infestations in the United States in 1964 were smaller and less severe than in the previous few years. There were many outbreaks, however, that damaged or destroyed forest resources over large areas and were costly to contain. Other outbreaks recurred after several years of dormancy, and a few were found at new locations. Many of the infestations, both new and recurring, will require suppression action in 1965.

As a group, bark beetles were the most troublesome pests. Their persistent outbreaks in the Intermountain and Rocky Mountain States took a heavy toll. Lodgepole pine stands in Idaho, Utah, and Wyoming were particularly hard hit, and chronic infestations seriously depleted high-value stands of western white pine in northern Idaho and ponderosa pine in the Rocky Mountains and in the Black Hills of South Dakota and Wyoming. At year's end, there was a resurgence of pine beetle infestations at several locations in the Southern and Southeastern States.

Forest defoliators also were troublesome and damaging at many locations throughout the country. Noteworthy were new and virulent outbreaks of the Douglas-fir tussock moth in California, Idaho, and Oregon. In addition, a serious fall cankerworm infestation intensified and spread in valuable hardwood stands in Pennsylvania. Spruce budworm remained epidemic in much of the mixed conifer forests of Montana, Idaho, New Mexico, and Minnesota, and a new outbreak was discovered in southern Utah. Larch casebearer infestations increased in size and severity in northeast Washington and in the larch type through most of Idaho and Montana. The black-headed budworm population increased in southeast Alaska. Miscellaneous insect pests, including aphids, weevils, scales, shoot and tip moths, needle miners, leaf tiers, spittlebugs, and many others, were troublesome locally in many sections of the country. Suppression of most infestations in 1964 was accomplished satisfactorily, and without undue or significant side effects.

Conditions in Western Forests

The extensive coniferous forests in the western United States have long been plagued by destructive insects, and the situation in 1964 was little changed.

In Oregon and Washington, the total acreage of infestations was the lowest of the past decade. However, the area affected by defoliators increased. Serious new outbreaks of Douglas-fir tussock moth developed in continuous stands of Douglas-fir, true firs, and intermingled conifers in central Oregon. Also, new infestations of balsam woolly aphid developed in lowland white fir stands in the coastal range of southern Oregon, and larch casebearer infestations increased in size and severity in northeast Washington.

The rapid buildup of Douglas-fir tussock moth in scattered areas from Modoc County to El Dorado County dominated forest insect conditions in California. Other pests important in previous years declined sharply. For example: losses from the fir engraver were the lowest in a decade; the western pine beetle was largely a local problem; and the lodgepole needle miner subsided to low levels.

In the Intermountain States, bark beetles in lodgepole pine were the worst offenders and killed more than 2 million trees in epidemic centers in Utah, Idaho, and Wyoming. Defoliators were damaging and destructive with the spruce budworm predominant among several. The gross area showing some defoliation by spruce budworm amounted to more than 2 million acres. The black-headed budworm became epidemic on about 40,000 acres, and an aspen leaf tier continued epidemic on some 170,000 acres. Pitch nodule moth activity rose sharply in many pinyon pine stands. There was a general increase

of the white-fir needle miner in southern Utah. With but two exceptions, both minor, Englemann spruce stands in the Intermountain States were nearly free of bark beetle activity.

The forests in the northern Rocky Mountains suffered attacks of bark beetles and defoliators alike. Chronic mountain pine beetle infestations resulted in 3- to 14-percent losses in northern Idaho white pine stands, and the same insect depleted ponderosa pine stands in parts of Montana. An epidemic of the Douglas-fir tussock moth spread over 190,000 acres of grand and Douglas-fir type in Idaho, and scattered outbreaks also occurred in Montana. Spruce budworm infestations continued at high levels on some 2.2 million acres in Montana and Idaho, and the larch casebearer continued its spread in both States. Forest tent caterpillar epidemics severely defoliated broad-leaved trees on large acreages in northern Idaho.

The Black Hills beetle was the most serious forest insect in the central Rocky Mountains, but concerted effort by land-managing agencies checked most infestations. A potentially serious outbreak of the Engelmann spruce beetle was discovered in the Green Horn Mountains in south-central Colorado, and a new outbreak of the Black Hills beetle occurred on the Medicine Bow National Forest in south-central Wyoming. Spruce budworm infestations in Colorado forests increased in size and severity, with activity centered along the eastern slope of the Sangre de Cristo Range, San Isabel National Forest.

Insect activity increased in the Southwest. Spruce budworm infestations in southern New Mexico spread from 50,000 to 90,000 acres, and those on 350,000 acres in the northern part of the State intensified. An Engelmann spruce beetle infestation erupted on Mt. Taylor, and new outbreaks of pine bark beetles seriously damaged ponderosa pine stands. The white-fir needle miner, previously unrecorded in the Southwest, damaged several thousand acres of white fir on the North Kaibab Plateau. The Douglas-fir beetle was particularly serious near Williams, Ariz., and the pinyon needle scale was again active at Grand Canyon National Park.

Conditions in the Central, Southern, Southeastern, and Northeastern Forest Regions

Conifer defoliators and hardwood borers were the most damaging insects in the Lake and Central States. The jack pine budworm increased in number and became general throughout large areas in northern Lower Michigan, Wisconsin, and in central and north-central Minnesota. The pine tussock moth also reached outbreak levels in parts of Wisconsin. Moderate to heavy carpenterworm and wood borer attacks on oaks continued at many locations in the Central States, and damage and degrade to attacked trees were severe.

The southern pine beetle remained the most troublesome insect in the South and Southeast, and a resurgence late in the year portends serious losses in 1965. Black turpentine beetle activity was local, but in the aggregate, killed many trees. The balsam woolly aphid killed many Fraser firs in the mountains of North Carolina, and infestations were found at several new locations. The loblolly pine sawfly was widespread in Arkansas and abundant at two locations in Louisiana.

Drought in the Northeast caused concern, especially in parts of Pennsylvania and New York, where valuable hardwood stands were heavily defoliated by the fall cankerworm and oak leaf rollers. New hemlock scale infestations are a potential threat to native hemlocks. Also, the red pine scale continued to spread slowly in southern New York and southwestern Connecticut. Activity of the forest tent caterpillar, hemlock looper, and the larch sawfly increased in Maine.

Suppression Activities

Federal and State agencies and owners and managers of private forest lands made concerted efforts during 1964 to check the damage and loss caused by insects. Overall, good progress was made in controlling virulent outbreaks of bark beetles and in suppressing widescale epidemics of forest defoliators. However, some infestations were unattended because of shortages of funds, lack of suitable control methods, or other reasons.

The largest control undertakings were against bark beetles in the Intermountain and Rocky Mountain Regions. Involved in mountain pine beetle control in lodgepole pine stands on the Ashley, Wasatch, Cache, Caribou, Teton, and Targhee National Forests in Idaho, Utah, and Wyoming were felling and burning, salvage and spraying of more than 250,000 trees. Black Hills beetle control in ponderosa pine in the Black Hills, S. Dak. and Wyo., the Big Horn Mountains, Wyo., and the Front Range Mountains, Colo., involved treatment of some 260,000 trees. Results against the beetles were reported to be good. However, new infestations at other locations and maintenance work, particularly in lodgepole pine stands in Idaho and Wyoming, will require additional large-scale control operations in 1965.

Bark beetle control in the pine stands of the South and Southeast continued, but at a reduced

rate. A total of 33 projects involved treatment of approximately 167,000 trees infested by the southern pine beetle and 654,000 trees and stumps infested by the black turpentine beetle.

The resurgence of southern pine beetle infestations at year's end in the South and Southeast portends a serious situation which might require an increase in control operations in 1965. Persistent infestations of the black turpentine beetle, particularly on parts of the Kisatchie National Forest, La., and on the National Forests in Texas, also will require additional effort.

Spruce budworm suppression on the Salmon National Forest in Idaho and on the Lolo and Deerlodge National Forests, Mont., was the major effort against defoliating insects. Approximately 525,000 acres were sprayed on the Salmon National Forest, and some 155,000 acres were treated on the two National Forests in Montana. Intensive monitoring of these spray projects, increased use of helicopters in spray operations, and use of the more expensive nonpersistent pesticides increased the cost of these projects over previous years.

A summary of pest control operations for 1964 is presented in the following tabulation.

Projects	*Location*	*Trees treated*	*Acres sprayed*
Mountain pine beetle	Utah, Idaho, Wyo	249,000	----------
Black Hills beetle	S. Dak., Colo., Wyo	260,000	----------
Southern pine beetle	South and Southeast	167,000	----------
Black turpentine beetle	----do	[1] 654,000	----------
Western pine beetle	California	12,500	----------
Engelmann spruce beetle	Colo., Utah, N. Mex	8,600	----------
Spruce budworm	Idaho, Mont., Maine	----------	775,000
Pine tussock moth	Wisconsin	----------	8,500
Tent caterpillars	Southwest	----------	2,500
Jack pine budworm	Michigan	----------	1,200
Miscellaneous insects	Countrywide	86,000	3,400
Total		1,437,100	790,600

[1] Includes treating of stumps.

Forest Insect Conditions in the Various Regions

OREGON AND WASHINGTON

By P. W. ORR, Division of Timber Management
Portland, Oreg.

Conditions in Brief

Destructive insect outbreaks occurred on about 1,150,000 acres of forest land in Oregon and Washington in 1964, the lowest acreage during the past decade. Of this, most was a result of outbreaks of various bark beetles. The area of infestations by defoliating insects increased while that of infestations by bark beetles and sucking insects decreased.

Serious new outbreaks of the Douglas-fir tussock moth developed in continuous stands of Douglas-fir, true firs, and intermingled conifers on the Malheur and Ochoco National Forests. Unless these populations are brought under control by natural factors before June 1965, chemical control will be needed to prevent wholesale tree killing.

New infestations of the balsam woolly aphid developed in lowland white fir stands in the Coastal Range of southern Oregon. Larch casebearer infestations also increased in size and severity in northeast Washington. No new outbreak of the western hemlock looper was detected in Oregon and Washington.

All known infestations of the European pine shoot moth outside the containment zone in western Washington have been eradicated. However, within the zone, the moth has become well established in several new communities. In Oregon, the eradication program was continued by destruction of several infested trees found in one area of Portland.

The only chemical control against bark beetles in Oregon was a small maintenance project against the mountain pine beetle in stands of lodgepole pine in Crater Lake National Park.

Status of Insects

Balsam woolly aphid, *Chermes piceae* (Ratz.). The acreage of fir stands infested by the balsam wooly aphid increased in Oregon but

decreased in Washington. Most of the damage to host trees occurred on Gifford Pinchot and Snoqualmie National Forests in Washington. In Oregon, the most severe and extensive infestations were on the Willamette, Rogue River, Umpqua, and Deschutes National Forests. New infestations developed in lowland white fir stands in the Coast Range near Coquille, Oreg. This is the southernmost balsam woolly aphid outbreak in the Coast Range.

The aphid is now well established in Crater Lake National Park and the upper Rogue River drainages. Most of the subalpine fir in the park and adjacent areas is threatened. Continued spread southward along the Cascade Mountains is likely.

The trend in damage by the aphid is expected to be static to slightly upward in Pacific silver fir and lowland white fir stands west of the Cascade Mountains. Tree killing in subalpine fir stands may increase in 1965.

About all that can be done in infested stands is to log affected trees and merchantable trees of declining thrift since no practical control measures have been developed.

Some limited insecticide tests may be undertaken in 1965. Research on insect predators is being continued on a maintenance basis.

Mountain pine beetle, *Dendroctonus ponderosae* (Hopk.) (*D. monticolae* Hopk.). Tree killing in western white pine stands increased moderately in Oregon but decreased significantly in Washington. In Oregon, most of the losses occurred on the Willamette, Mount Hood, and Umpqua National Forests. In Washington, losses were centered in the Olympic National Park and on the Gifford Pinchot, Wenatchee, Olympic, Snoqualmie, and Kaniksu National Forests, or adjacent forest lands.

The acreage of infested lodgepole pine increased slightly in Oregon, where losses were most extensive on and near the Fremont, Winema, and Deschutes National Forests. Infested acreage decreased significantly in Washington. The largest outbreaks occurred on the Colville and Okanogan National Forests.

Outbreaks in stagnated pole-size ponderosa pine stands increased significantly in both States. Losses in Oregon were centered on or near the Wallowa-Whitman and Malheur National Forests. In Washington, the heaviest and most severe losses occurred on the Okanogan, Colville, and Umatilla National Forests and on the Colville Indian Reservation. This pine beetle problem in young ponderosa pine will increase in the future as more and more areas stagnate.

Mountain pine beetle outbreaks increased in sugar pine stands in southern Oregon. Losses were centered in the Siskiyou Mountains and on the Sikiyou National Forest.

The trend is expected to be downward in Washington white pine stands but slightly upward in Oregon. Lodgepole pine losses are expected to decrease. The trend of losses in ponderosa pine stands is significantly upward in both States. Sugar pine losses should continue at about the same level in Oregon forests.

Control is impractical in western white pine in Oregon and Washington because of blister rust prevalence. Salvage of infested trees and intermingled green trees is encouraged to reduce beetle populations and salvage timber values. Maintenance control in lodgepole pine stands will probably be carried out in Crater Lake National Park in 1965. To relieve competition in stagnated ponderosa pine stands and improve tree vigor, thinning is encouraged in both States.

Fir engraver, *Scolytus ventralis* LeC. Most trees killed by the fir engraver were in immature and decadent true fir stands. The infested area in Oregon about doubled while that in Washington decreased slightly. In Oregon, losses were heaviest and most extensive on the Fremont, Wallowa-Whitman, Umatilla, and Ochoco National Forests. In Washington, infestations centered on the Umatilla, Wenatchee, and Kaniksu National Forests. Fir engraver losses generally increase during drought but subside quickly when moisture returns to normal.

Logging merchantable infested trees and trees of declining thrift is about all that can be done under forest conditions to prevent excessive loss.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. Moderate to severe Douglas-fir beetle outbreaks developed locally in the southern Oregon Coast Range. They extended from the Alsea River southward to the Umpqua River drainages, and eastward to the Willamette Valley. In this area, groups attacked ranged from a few trees to as many as 100. From the Umpqua River drainages south to the California line, attacks on scattered small groups and single trees were fairly common. Douglas-fir beetle losses increased slightly in the Cascades, but the area involved was small. Heavy losses in eastern Oregon centered on the Wallowa-Whitman and Umatilla National Forests. Outbreaks decreased in Washington. The larger centers of damage were on the Okanogan, Colville, and Umatilla National Forests, and on the Colville Indian Reservation. Only minor infestations occurred in western Washington.

In western Oregon, losses will probably increase moderately, with some heavy to very heavy losses locally. Losses in eastern Oregon are likely to increase. Continued low level tree killing is forecast in both eastern and western Washington. Stepped-up salvage of infested

trees and any adjacent windthrown trees is essential to reduce beetle population and resultant tree killing.

Salvage of the 1962 Columbus Day blowdown continued in 1964. Approximately 70 percent of the accessible down timber has now been salvaged on National Forests but much remains in inaccessible areas. Some of this timber remains attractive to the beetle and may be a source of population buildup in 1965.

Western pine beetle, *Dendroctonus brevicomis* LeC. The scope of infestations in mature ponderosa pine stands increased in Oregon but decreased in Washington. However, most out-

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Two-hundred-year-old Douglas-firs killed by the Douglas-fir beetle near Crow, Oreg. Each tree contains about 3,000 board feet of timber.

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breaks in both States declined in severity. Most tree mortality in 1964 occurred on the Malheur, Ochoco, Fremont, Umatilla, and Winema National Forests in Oregon. Increased single tree and small group killing was common on many eastside Oregon and Washington forests, indicating the possibility of more serious infestations next year. In Washington, outbreaks occurred on the Yakima Indian Reservation and on the Okanogan and Wenatchee National Forests. In most pine forests, an increase was noted in the number of widespread subepidemic losses, indicating that a general buildup may be in progress in both States. The damage trend is static to downward, with some increased local mortality. Continued losses in mature and decadent stands are likely until high-risk elements are removed. Hence, increased sanitation-salvage logging is recommended in this type of stand.

Oregon pine ips, *Ips pini* (Say). (*I. oregonis* (Eichh.)). Tree killing in ponderosa pine saplings and pole stands decreased significantly in Oregon but remained static in Washington. The largest infestations were on or near the Malheur, Winema, and Mount Hood National For-

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Salvage logging of windthrown and beetle-infested Douglas-fir is being continued to prevent additional attack and to save timber values.

ests in Oregon, and on the Colville Indian Reservation, Glenwood District, and Colville National Forest in Washington. Most were on dry fringe-type sites. A downward damage trend is expected in both States. Good silvicultural practices usually preclude the need for direct control.

Engelmann spruce beetle, *Dendroctonus obesus* (Mann.). (*D. engelmanni* Hopk.). Engelmann spruce beetle infestations in Engelmann spruce stands in both States declined significantly. The few remaining damage centers were in inaccessible areas of the Wallowa-Whitman and Umatilla National Forests in Oregon, and in the Okanogan and Umatilla National Forests in Washington. The trend was not determined, but is presumably downward.

In accessible stands, infested trees should be logged to reduce beetle populations and save timber values. Windthrown spruce should be salvaged at the same time since it serves as breeding sites for the beetle.

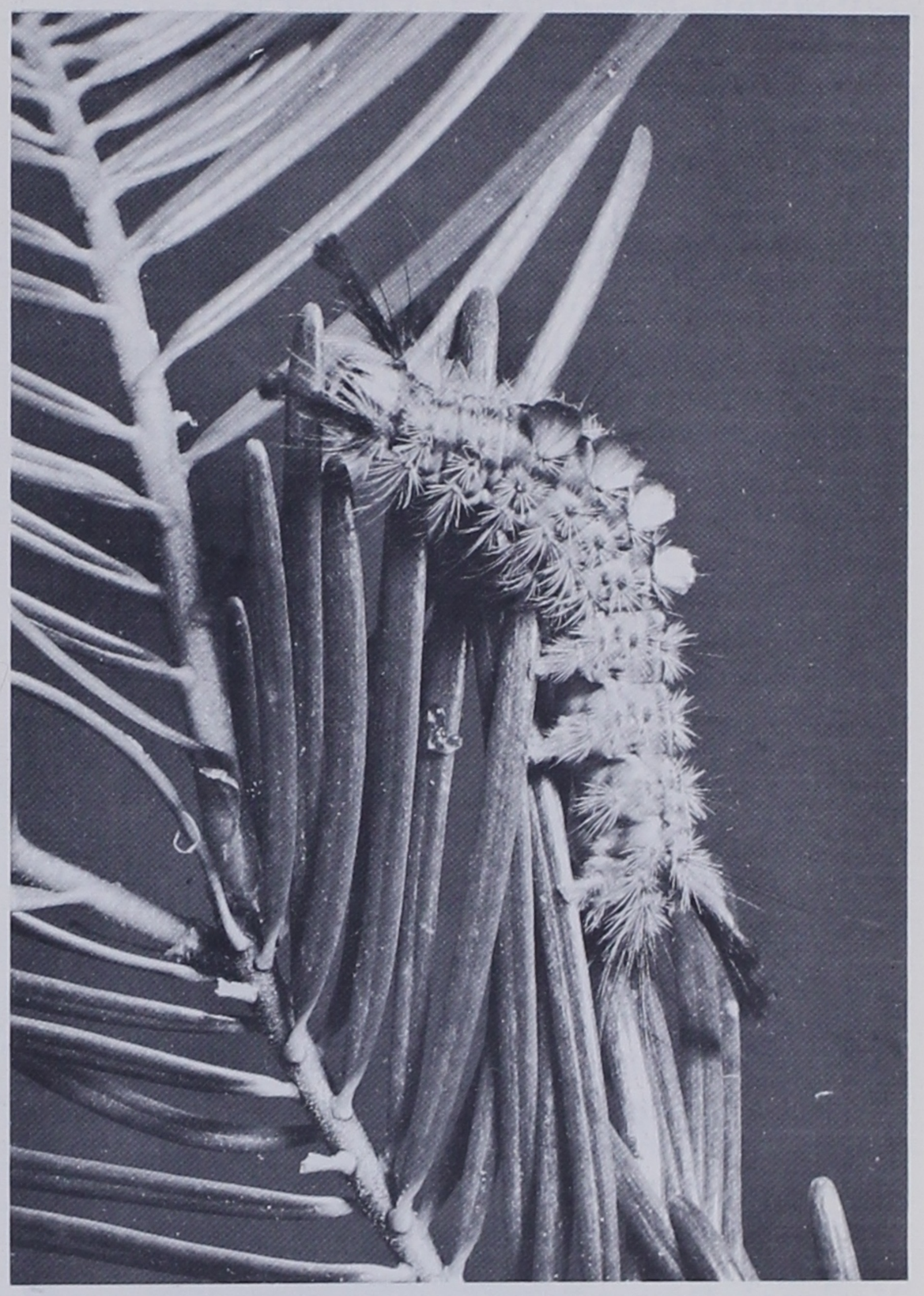
Silver fir beetle, *Pseudohylesinus* spp. In Pacific silver fir stands, trees killed by silver fir beetles declined to a low level. Infestations centered on the Mount Baker and Snoqualmie National Forests and in Olympic National Park, Wash. Subepidemic tree mortality was common in northwest Washington forests. Losses are expected to continue to be low in 1965. Logging of the infested trees is the only means available for reducing beetle populations and for saving timber values.

Larch casebearer, *Coleophora laricella* (Hbn.). Larch casebearer infestations in northeast Washington increased in size and severity. Defoliation ranged from light to extreme, but no trees died. The heaviest outbreaks were on or near the Colville and Kaniksu National Forests and on the Northeast Washington district of the Washington State Department of Natural Resources.

Subepidemic damage occurred outside the heavily infested area at widespread points in northeast Washington from the Idaho line west to Deer Park. The trend of damage is apparently upward. No control is needed in 1965.

Douglas-fir tussock moth, *Hemerocampa pseudotsugata* McD. Infestations in Douglas-fir, true firs, and intermingled conifers ranged from a few trees to several hundred acres on the Northeast Washington district and areas adjacent to the Colville National Forest. Many were in farm woodlots or other isolated stands. In these areas tree killing was common.

In Oregon, serious outbreaks developed in continuous forest stands on the Malheur and Ochoco National Forests. Some tree killing has occurred and more is imminent. Infestations now occupy about 40,000 acres. About 70,000 acres may need to be sprayed in 1965 for control.



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Full-grown tussock moth larva feeding on Douglas-fir foliage.

The trend is generally downward in northeast Washington, with some local tree killing possible. In Oregon, an upward trend is expected at all major infestation centers.

The need for control on the Malheur and Ochoco National Forests in Oregon is being determined.

Examination of Douglas-fir tussock moth egg masses in the problem areas showed that the 1965 feeding population will be more numerous and probably more destructive than in 1964.

Noctuid moth, *Xylomyges simplex* (Wlk.). An outbreak occurred on about 8,000 acres of Douglas-fir and associated conifers on the Siuslaw National Forest in Oregon. Light to moderate defoliation resulted from the one season's feeding. The trend of the outbreak is unknown since this is the first record of this insect causing any extensive damage. An evaluation of the infestation is planned. Since so little is known

about the insect's habits, no control is recommended for 1965.

Western oak looper, *Lambdina fiscellaria somniaria* (Hulst). Outbreaks on Oregon white oak and Oregon ash continued in the Willamette Valley area near Dallas, Sheridan, and Willamina, Oreg. Disease and parasites apparently controlled the outbreaks at older infestation centers. The damage trend is probably downward. No control is needed in 1965 to save trees. Infestations in individual woodlots and on shade trees can be controlled by aerial or ground applications of DDT or other insecticides.

Pine needle miner, *Recurvaria* sp. Light to moderate defoliation of lodgepole pine occurred on the Deschutes National Forest near Wickiup and Crane Prairie Reservoirs. The damage is expected to subside; hence, no control will be needed in 1965.

Spruce budworm, *Choristoneura fumiferana* (Clem.). Defoliation was light to moderate in Douglas-fir, lowland white fir, subalpine fir, western hemlock, and Engelmann spruce on the Northeast Washington district, east of the Columbia River, and on the Kaniksu National Forest in northeast Washington. For the first time since aerial surveys began in 1947 no infestations were detected in Oregon. No control is needed in 1965.

Sawfly, *Neodiprion* sp. Defoliation of western larch, ranging from light to heavy, occurred in Oregon forests. Small infestations present on the Wallowa-Whitman National Forest in 1963 decreased significantly. One new infestation developed on the White River, Mount Hood National Forest. In these infestation areas, both mature and immature trees were attacked; most defoliation occurred late in the season. The trend of infestations is unknown, but no control is needed in 1965. The infestation on the White River, Mount Hood National Forest, is heavily parasitized.

Western hemlock looper, *Lambdina fiscellaria lugubrosa* (Hulst). In Washington, no new epidemic outbreaks of the hemlock looper were detected in the areas around Willapa Bay that were sprayed in 1963. Some light larval feeding occurred on areas reserved for experimental work within the boundaries of the spray project. On these areas some foliage survived this year's feeding. No outbreaks were detected in Oregon on or near the 1962 Astoria control project. Defoliation is likely to decrease in both States; hence, no control is needed in 1965.

European pine shoot moth, *Rhyacionia buoliana* (Schiff.). Mugho and Scotch pines are preferred hosts in the Northwest, but 15 pine species and varieties in ornamental plantings have been attacked in the past at one time or another.

In Washington, 41 communities were surveyed outside the containment zone. In Oregon, 63 communities were surveyed. No new infestations were found outside the zone.

Within the containment zone, spread of the shoot moth has been steady, and new infestations were discovered in several new communities. It is believed to be only a matter of time before this moth is spread throughout the district.

Eradication surveys were again made in Spokane, Wash., and Portland, Oreg. For the third successive year, no infestations were found at Spokane, indicating a successful eradication program. In Portland, 14 infested pines were found and destroyed. Thirteen of the infested trees were in one locality in southeast Portland. The other was in a city park not far from the infestation center.

Cooperative research is being planned to determine if biological control of the shoot moth with the sterile male technique is feasible. The research will be undertaken by the Pacific Northwest Forest and Range Experiment Station and its cooperators.

Other insects. A tussock moth, *Hemerocampa* sp., defoliated huckleberry and other shrubs on large areas of the Wallowa-Whitman National Forest and occurred in lighter numbers on the Malheur National Forest. Disease and parasites are expected to reduce the population in 1965.

Phantom hemlock looper, *Nepytia phantasmaria* (Strecker), caused light defoliation of ornamental Douglas-firs in a Portland, Oreg., suburb. A heavy moth flight occurred in late September and October.

Laspeyresia sp. and *Conopthorus* sp. damage to ponderosa pine cones and seeds in eastern Oregon and Washington was light to heavy. *Megastigmus* sp. and *Contarinia* sp. infestations ranged from moderate to heavy in western Oregon and Washington. Western white pine seed loss caused by *Eucosma* sp. and *Conopthorus* sp. was only slightly above normal.

CALIFORNIA

By JOHN R. PIERCE, Division of Timber Management, San Francisco, Calif.

Conditions in Brief

A rapid buildup of Douglas-fir tussock moth dominated forest insect conditions in California in 1964. It seriously defoliated white fir in six areas comprising 78,000 acres from Modoc County to El Dorado County. Very light populations also were detected in three additional areas. Fall egg-mass surveys indicated that

populations were increasing in most of the outbreak areas. Some tree mortality, considerable top killing, and heavy loss in Christmas trees occurred from 1964 feeding.

White-fir sawfly and two species of midges in Douglas-fir damaged several high-value Christmas tree management areas.

In contrast to the increasing or persistent problems, some important insect pests declined sharply in 1964. Damage by the fir engraver was the lowest in several years. The lodgepole needle miner population in Yosemite National Park subsided to a low level following the action program initiated by the National Park Service in 1959. The western pine beetle, reported to be declining last year, was largely a local problem in 1964. Prompt salvage of windthrown Douglas-fir averted a bark-beetle buildup in the north coast subregion.

The persistence of a 7,500-acre pandora moth outbreak caused considerable growth loss in Jeffrey pine stands of the Kern Plateau. The spruce budworm infestation in Modoc County declined in 1964 and is no longer damaging fir stands in the Warner Mountains. In northeastern California, the destruction of sagebrush by the sagebrush defoliator continued over large areas.

Insect pests of young plantations, particularly tip moths and grasshoppers, were a source of serious, although local, damage in 1964. In Fresno County a grasshopper invasion, which had seriously damaged a 6-year-old ponderosa pine plantation, was controlled by aerial application of sevin.

Elsewhere in the State, insect activity was local in extent or involved less well-known insects. Among the latter were the black pine leaf scale on sugar pine; a pine chafer on fir; the fall webworm, oak moth, and tent caterpillars on hardwoods; a gall midge on fir; a bark scale on oak; twig beetles on pine; and a needle miner on Jeffrey pine.

Suppression activities in 1965 will involve a continuation of the silvicultural control of bark beetles and some plantation insects. Direct control with chemical sprays will be needed to combat bark beetles on maintenance control projects in some recreation areas and at other locations. Aerial spraying will be needed to control outbreaks of the Douglas-fir tussock moth and may be needed to combat insect damage in small plantation areas.

Status of Insects

Douglas-fir tussock moth, *Hemerocampa pseudotsugata* McD. Defoliation of white firs by this moth reached epidemic proportions in 1964. Six large infestations, totaling 78,000 acres, occurred in Modoc, Lassen, Plumas, and El Dorado Counties.

In areas of heavy and medium feeding by this insect, some trees were killed outright, top killing was common, and severe defoliation was widespread in mature and pole-size stands. In the smaller size classes, losses were more severe, with the greatest immediate economic impact in Christmas tree production areas.

F–509841

Female Douglas-fir tussock moth and a newly laid egg mass on old cocoon. Modoc National Forest, Calif.

Egg-mass surveys, conducted cooperatively by the Forest Service, the California Division of Forestry, and industrial foresters, indicated a strong upward trend in tussock moth populations in some infestations and a static to increasing trend in the remaining ones. All of the infestations are potentially dangerous and capable of causing additional damage and spread into new areas.

White-fir sawfly, *Neodiprion abietis* complex (Harris). Feeding damage by this defoliator of white fir was detected at many locations in northern and central California. Activity was greatest at Knox Mountain, Stowe Reservoir, and Joseph Creek, Modoc County; at Military Pass-Black Fox, Siskiyou County; and at Bailey Ridge, Calaveras County.

Egg counts made during the winter and spring of 1963-64 in the Knox Mountain and Bailey Ridge infestations indicated medium-level populations. In the Knox Mountain infestation where high-value Christmas tree production areas were threatened, 2,800 acres were sprayed with DDT and 320 acres were sprayed with malathion. This project was a cooperative effort involving State, industry, and Federal participation. Other infestations were not treated. The Knox Mountain project showed that both DDT and malathion are effective in combating this insect. The DDT application also controlled the tussock moth in the treated area.

F–509839

Gregarious feeding and damage by white-fir sawfly larvae. Modoc National Forest, Calif.

Douglas-fir gall midge, *Contarinia pseudotsugae* Condr. Attacks on the needles of Douglas-fir by this midge and by a related species (probably *C. cuniculator* Condr.) made many Christmas trees unsalable in the Jarbo Gap area of Butte County.

Pandora moth, *Coloradia pandora* Blake. A 7,500-acre infestation of this pine defoliating moth continued in the Taylor Meadow-Bartolas country area of Tulare and Kern Counties. The outbreak caused moderate to heavy damage in local infestation centers. Pupal and egg counts taken in 1964 indicated that the infestation may be stable or declining. A light population of this insect was present in the Laguna Mountains, San Diego County.

Lodgepole needle miner, *Recurvaria milleri* Busck. Survey findings indicate that needle miner populations near Tuolumne Meadows, Yosemite National Park, have declined sharply from epidemic levels 2 years ago and that continued control action may not be required. The decline is attributed to the control work started by the National Park Service in 1959. Also, natural enemies, which apparently have not been seriously affected by the control work, have increased. The survey also revealed that damage to trees inside treated areas was considerably less than where no work had been done.

At Woods Creek, Kings Canyon National Park, needle miner populations were found to be low in areas protected by spraying but considerably higher outside the protection zones. The infestation at Sentinel Meadows, Mono County, continued.

Spruce budworm, *Choristoneura fumiferana* (Clem.). Predictions of a decline in the activities of this defoliator were confirmed when no additional damage occurred in the infested portion of Modoc County. A survey of budworm eggs, made in 1964, indicated that the spruce budworm would remain at a low level in 1965. The budworm was detected on Knox Mountain, approximately 50 miles south of the previous limits of the known infested area. No appreciable damage was found at this location.

Western pine beetle, *Dendroctonus brevicomis* LeC. Tree killing continued at a rate much reduced from the high losses sustained as recently as 1962, but at the current endemic level, the western pine beetle destroyed much timber throughout California. The most active infestations in 1964 were at the following locations: Hume Lake, Indian Basin, and Balch Park, Tulare County; Saddle Camp and Antelope Creek, Tehama County; Hat Creek and Grizzly Peak, Shasta County; Pierce Creek, Plumas County; Cecilville and McCloud, Siskiyou County; Beaver Mountain and Parker Creek, Modoc County.

In southern California, western pine beetle activity declined also. Losses above an acceptable level occurred at only two locations in maintenance control areas: Lake Arrowhead, San

Bernardino County, and Ranger Peak, Santa Barbara County. In 10 other maintenance control areas, losses have been reduced to an endemic level. Uncontrolled outbreaks are still active at Julian, Palomar Mountains, and Agua Tibia, San Diego County; and Crab Flats, San Bernardino County. Control action has been initiated at Agua Tibia and Crab Flats.

Mountain pine beetle, *Dendroctonus ponderosae* (Hopk.) (*D. monticolae* Hopk.). Serious damage to pole and young sawtimber-size ponderosa pine continued at Joseph Creek in Modoc County. A thinning project in this area reduced losses. Another serious outbreak in ponderosa pine south of Fort Bidwell will receive sanitation-salvage treatment in 1965. The outbreak reported in 1963 in young sugar pine at Miami Creek, Mariposa and Madera Counties, and Shaver Lake, Fresno County, subsided. Logging to thin the overstocked stands and the removal of infested trees aided materially in reducing losses in the Miami Creek outbreak.

Throughout central and northern California a persistent, high-endemic loss of mature sugar pine continues. In most areas, infested trees are too widely scattered to permit effective control at the present level of infestation. Infestations of this type were most noticeable in the general area of Balch Park and Hume Lake, Tulare County; Happy Camp and McCloud, Siskiyou County; Grizzly Peak, Shasta County; Antelope Creek, Tehama County; and Pierce Creek, Plumas County. In addition, the beetle was active in lodgepole pine in the Summit Meadows of the Kern Plateau, Goosenest, and Skunk Cabbage areas in Modoc County.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. The threatened outbreak of the Douglas-fir beetle in windthrown timber from

F—509840

Large plastic sheet placed over a livestock watering hole to prevent water contamination during aerial spraying. Modoc National Forest, Calif.

the Columbus Day storm in 1962 failed to develop. Prompt salvage of windthrown trees by all land managers is believed to have averted the serious losses that were expected in the spring of 1964. Local beetle buildups in windthrown Douglas-fir occurred at Hoopa Valley Indian Reservation; at Bluff Creek, Humboldt County; and Fort Goff, Siskiyou County. Logging of infested trees is planned in 1965.

Fir engraver, *Scolytus ventralis* LeC. The statewide outbreak of this beetle that was reported as continuing at a fairly high level in 1963 subsided in 1964, with very few centers of infestation remaining active. A moderate problem persisted at Cedar Pass in the Warner Mountains and Squaw Valley, Plumas County.

Jeffrey pine beetle, *Dendroctonus ponderosae* (Hopk.) (*D. jeffreyi* Hopk.). Tree killing in Jeffrey pine by this bark beetle continued in the southern Warner Mountains, Modoc County; at Butte Creek, Lassen County; the Summit Meadows area of the Kern Plateau; and Thomas Mountain, Riverside County. Elsewhere in the State beetle activity remained at a low level.

Ips (pine engraver), *Ips* spp. An increase in the density of ips populations in slash was reported from several locations in central and northern California in 1964, but only a few serious attacks occurred in standing trees.

Widespread killing of knobcone pine was reported near Cecilville and McCloud in Siskiyou County and Alder Creek, San Bernardino County. These infestations may jeopardize adjacent ponderosa pine stands if precipitation is deficient during the spring and early summer of 1965.

Red turpentine beetle, *Dendroctonus valens* LeC. Red turpentine beetle activity subsided to an endemic level in all portions of the State.

California flatheaded borer, *Melanophila californica* Van Dyke. Tree killing by this beetle remains serious only in Garner Valley, Riverside County. Elsewhere in the State the flatheaded borer killed only occasional trees.

Twig beetles. Severe twig killing on Torrey pine by a twig beetle, *Pityophthorus carmeli* Sw., was reported at Del Mar, San Diego County. The damage occurred on frost-injured twigs on trees growing on exposed sites. Similar twig-beetle attacks on frost-injured twigs occurred at Heaps Peak, San Bernardino County, and at Mount Pinos, Ventura County.

Plantation insects. The devastating grasshopper, *Melanoplus devastator* Scudder, severely damaged young pine plantations at three locations. The Good Mill Plantation in Fresno County was sprayed in June of 1964 by the Agricultural Research Service after grasshoppers had defoliated 6-year-old ponderosa pines in 1963. An area of predominately meadow land, but containing some pine reproduction on the edge, was sprayed at Long Valley in Modoc County. Later in the year heavy feeding in the Eel River Plantation, Mendocino County, was reported.

The ponderosa pine tip moth, *Rhyacionia zozana* (Kearf.), and the pine needle sheath miner, *Zelleria haimbachi* Busck, were unusually active at the Institute of Forest Genetics near Placerville. The tip moth also was responsible for minor, localized damage in other plantations, notably the Chaparral Plantation in Butte County. The high-value planting of grafted rust-resistant sugar pines at Badger Hill, El Dorado County, was sprayed to protect the pines against tip moth attack; no other infestations warranted chemical control.

Pine reproduction weevil, *Cylindrocopturus eatoni* Buch. There were very few reports of damage in 1964, although the weevil is known to be active in several areas. Since chemical treatment has usually failed to provide lasting protection against this insect, land managers are turning more to cultural practices to avoid heavy damage.

Cone and seed insects. Nearly all conifer species had a good to abundant cone crop in 1964. Consequently, cone and seed insects became more thinly distributed in the greatly increased volume of available host material, with the result that damage by these insects was less than is customary.

Browse and range insects. The destruction of sagebrush by the sagebrush defoliator, *Aroga websteri* Clarke, continued at an epidemic level in Modoc, Siskiyou, and Lassen Counties. Extensive areas of sagebrush that were heavily defoliated in 1963 are now dead. Heavy parasitism, indicating a probable decrease in defoliation and damage in 1965, was found in the defoliator population in many areas.

Other insects. The black pine leaf scale, *Aspidiotus californicus* Coleman, caused a top decline of sugar pine near Callaham, Siskiyou County. A small outbreak of Jeffrey pine needle miner, *Recurvaria* sp., discovered in 1963 at Snow Valley, San Bernardino County, continued but caused no serious damage. The fall webworm, *Hyphantria cunea* (Drury), defoliated madrone and other hardwoods along the Klamath River in Siskiyou County. A small outbreak of the same insect was reported near Placerville. The oak moth, *Phryganidia californica* Pack., was discovered on tanoak near Orleans, Humbolt County. A bark scale, *Asterolecanium minus* Lind., damaged interior live oak trees near Barberville, Humboldt County. *Dichelonyx* sp. destroyed most of the new growth on white fir in a small area in the vicinity of Black Fox, Siskiyou County. In southern

California, a new outbreak of the bluesided tent caterpillar, *Malacosoma constrictum* Stretch, on oak developed in the San Servaine area of San Bernardino County and Richie Creek, San Diego County. The pinyon sawfly, *Zadiprion rohweri* (Midd.), was present in low numbers in the vicinity of Crystal Lake, Los Angeles County. The balsam fir gall midge, *Cecidomyia balsamicola* Lintner, was collected for the first time on white fir in California near Susanville, Lassen County, and at Knox Mountain, Modoc County.

Undetermined problem of Douglas-fir. A rather widespread top decline of Douglas-fir reproduction has been reported near Orick, Humboldt County. The cause of this disorder has not yet been determined. A wooly aphid is associated with the damage, but a disease organism or physiological condition could also be responsible.

INTERMOUNTAIN STATES

By R. I. WASHBURN, Division of Timber Management, Ogden, Utah

Conditions in Brief

A large variety of insects caused losses to forest resources throughout the Intermountain Region. On an overall basis, insect infestations were more serious than in 1963. Bark beetles were the worst offenders, but defoliators also were troublesome.

The mountain pine beetle remained epidemic throughout most of the lodgepole pine forests in the Region. In 1964 over 2 million lodgepole pines were infested in epidemic centers compared with about 500,000 trees infested in 1963. Logging, burning, and chemical treating of slightly more than 300,000 infested trees were used to reduce losses in high-value areas. The trends of other bark beetles varied, but for the most part the downtrend of 1963 continued.

The spruce budworm epidemic in Idaho persisted. The gross area showing some defoliation in 1964 amounted to slightly more than 2 million acres. Approximately 525,000 acres of infestations were aerially sprayed with DDT. A new outbreak of spruce budworm was discovered in southern Utah. The black-headed budworm became epidemic on about 40,000 acres near McCall, Idaho.

Infestations of miscellaneous defoliators were scattered throughout the Intermountain States. A leaf tier was epidemic in many aspen stands; and while severity of damage increased, fewer acres were defoliated than in 1963. A geometrid continued to cause heavy mortality in mountain mahogany in southwestern Idaho. A sharp rise in pitch nodule moth activity was noted in many pinyon pine stands. A tiger moth on pinyon pine and an unknown but similar insect defoliating junipers caused extensive damage in several pinyon-juniper stands in Utah.

Tube moth infestations in lodgepole pine stands in eastern Idaho increased in size and severity of damage. Tussock moths were epidemic in three new areas, but other outbreaks active the past few years became inactive or began to decline. Spider mites were particularly abundant in the area treated for budworm in 1963, but were also prevalent on a variety of conifers elsewhere. There were localized outbreaks of leaf and needle miners, tent caterpillars, miscellaneous bark beetles, and sucking insects on preferred host trees at many locations.

Status of Insects

Mountain pine beetle, *Dendroctonus ponderosae* Hopk. (*D. monticolae* Hopk.). The lodgepole pine forests of the Intermountain Region are characterized by an abundance of overmature, decadent timber. In 1954 it became evident that the mountain pine beetle was starting an upward trend in the lodgepole pine forests of western Wyoming and southeastern Idaho and increased by three to fivefold in each year since. There are now over 2 million infested lodgepole pines in epidemic centers on the Teton National Forest and Grand Teton National Park, Wyo.; Targhee and Caribou National Forests, Idaho; and Cache National Forest, Utah and Idaho. The epidemic condition is expected to continue, and in all likelihood damage will be more severe and widespread in 1965. The development of the condition has followed a general pattern: small, widely scattered infestations start; then increase in size and intensity until they coalesce into large infestations, each containing thousands of infested trees. The same pattern appeared to be developing in the Greys River area of the Bridger National Forest, Wyo., and on the eastern half of the Caribou National Forest, Idaho. Both logging and chemical control have been concentrated in selected areas in an effort to reduce the losses.

Five major control projects were undertaken in 1964 on the Teton National Forest and Grand Teton National Park, Wyo.; Targhee and Caribou National Forest, Idaho; and Cache and Wasatch National Forests, Utah. All together over 300,000 infested trees were logged, treated with a toxic chemical, or burned.

The large persistent outbreak on the Wasatch National Forest, Utah, which had been treated annually since 1958 was brought under control.

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The infestation which has been active for the last few years on the Ashley National Forest, Utah, shows evidence of a general decline.

The mountain pine beetle is at a relatively low level in the ponderosa pine stands of the Intermountain States.

Spruce budworm, *Choristoneura fumiferana* (Clem.). The persistent outbreak of the spruce budworm in southern Idaho continued to increase in scope and severity. In 1964 slightly more than 2 million acres was defoliated to an intensity visible from the air. Sixty percent of the area, most of which has been infested for 4 or more years, was heavily defoliated. Tree mortality has occurred at an accelerated rate over the last 3 years and became substantial in 1964 in areas of repeated heavy defoliation.

In 1964 an aerial spray program was conducted on the Salmon National Forest, Idaho. A total of 525,000 acres of infestation was sprayed with DDT. Most of the area received 1 pound of DDT per acre, but about 7 percent of the project area received one-half pound per acre. An area of approximately 75,000 acres was left untreated along streams to minimize possible adverse effects to fish and fish food organisms. The ½-pound dosage was also applied as a strip between the 1-pound application and the unsprayed streamsides. Satisfactory control was achieved on the area sprayed with the 1-pound dosage, but 23 percent of the area sprayed with the ½-pound dosage was assessed as unsatisfactory. Comprehensive montitoring was conducted to assess the effects of the spraying on terrestrial and aquatic wildlife.

On the basis of budworm egg mass surveys, epidemic conditions are expected to continue in 1965, except in the areas treated in 1963–64.

A new 20,000-acre outbreak of the spruce budworm was discovered on the Fishlake National Forest in southern Utah.

Black-headed budworm, *Acleris variana* (Fern.). A new outbreak of the black-headed budworm was discovered in 1964 on the Payette National Forest, Idaho. The infestation covers about 40,000 acres and is characterized by localized concentrations of moderate defoliation. The hosts are true fir, Douglas-fir, and Englemann spruce, with true firs preferred. The infestation is expected to persist through 1965.

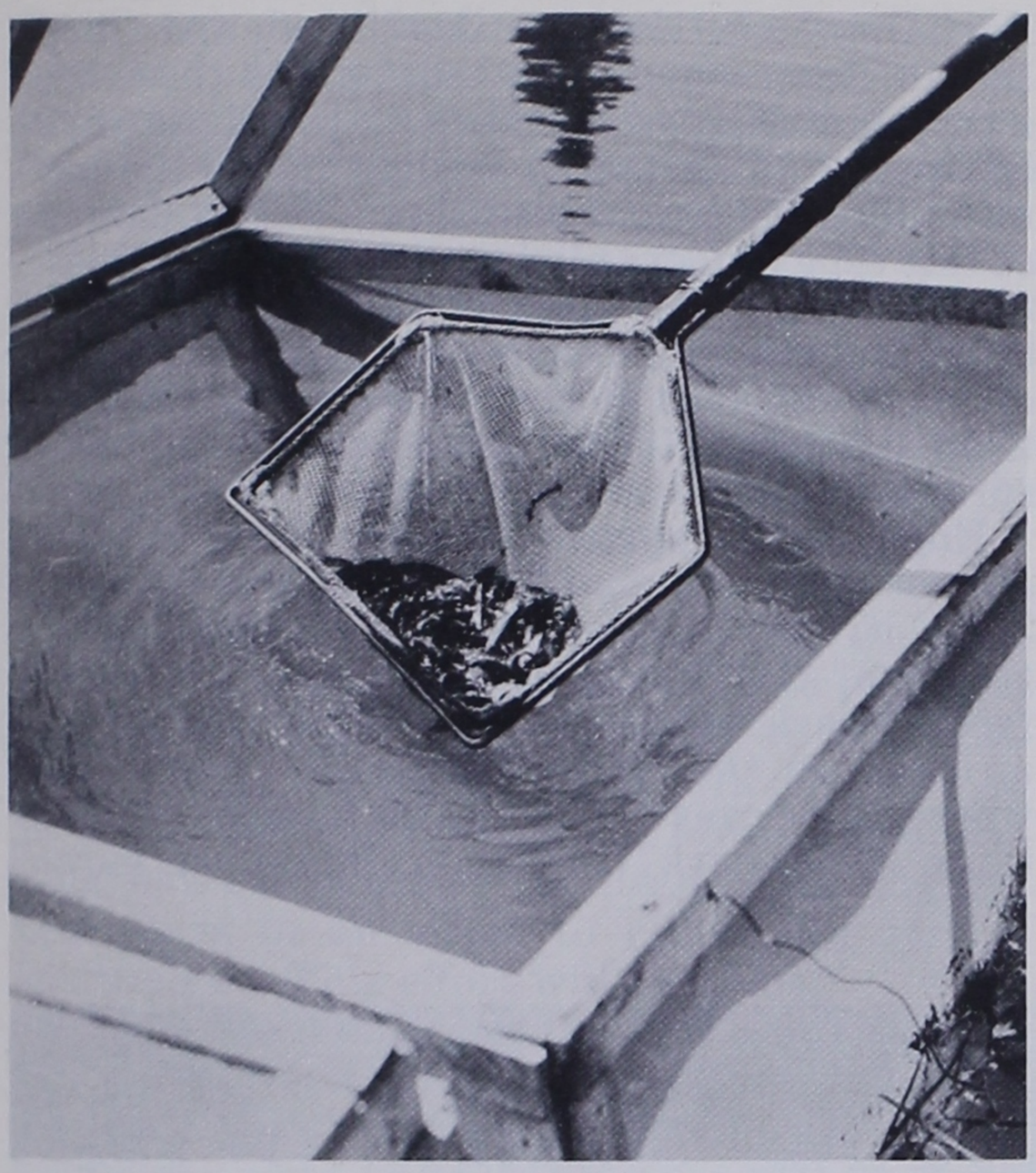
Tube moth, *Argyrotaenia* sp. A tube moth infestation in lodgepole pine has been epidemic on the Targhee National Forest, Idaho, since 1961. The damage has varied in intensity from year to year and by localities. In 1964 over 100,000 acres were infested; damage was classed as severe on 53,000 acres. The infestation is compounded by spot infestations of three other defoliators affecting lodgepole pine throughout the area. They are the pine needle sheath miner, *Zelleria haimbachi* Busck; the jack pine budworm, *Choristoneura pinus* Free.; and another budworm, *Choristoneura lambertianae* (Busck). Damage from this combination of insects is expected to increase markedly in 1965.

A geometrid, *Anacamptodes clivinaria* (Guenee). Since 1962 stands of mountain mahogany in the Juniper Mountain area of Owyhee County, Idaho, have been severely defoliated by this geometrid. In the last 2 years there has been a gradual decline in population densities of the insect in areas where the epidemic has persisted; however, repeated defoliation has caused extensive mortality to this valuable browse species. The epidemic is expected to continue through 1965, but with a further decline in population density.

White fir needle miner, *Epinotia meritana* Hein. A general increase in this needle miner occurred in 1963 in southern Utah. The increasing trend continued in 1964. The needle

F–509398

Biologists carefully check spruce budworm larval development to assure that aerial spraying is properly timed for control. Salmon National Forest, Idaho.



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Live fish were placed in boxes in streams to determine possible adverse effects of aerial spraying for control of spruce budworm. Salmon National Forest, Idaho.

miner is now epidemic over several thousand acres of white fir on the Dixie National Forest, Utah. In adjoining Bryce Canyon National Park the population has not yet reached epidemic proportions, but is increasing. Defoliation in 1965 is expected to average 50 percent on the Dixie National Forest but should be considerably less in Bryce Canyon National Park. The present infestations are in areas that have been seriously defoliated by the needle miner in the past.

Great Basin tent caterpillar, *Malacosoma fragile* (Stretch). The Great Basin tent caterpillar has been epidemic for the last 3 years along the Virgin River and in other localized areas in southern Utah. In 1964 nearly all of the aspen, cottonwoods, and several species of herbaceous plants were completely defoliated. The infestation on cottonwoods in the canyon bottoms of Zion National Park was particularly aggressive. On many trees there, more than 200 tents were formed by caterpillar colonies. Widespread, localized outbreaks of this insect also occurred in western Wyoming and eastern Idaho. Epidemic conditions are expected again in 1965. A control program using *Baccillus thuringiensis* Berliner was successful in reducing the tent caterpillar population in Bryce Canyon National Park where bitterbrush was the preferred host.

Aspen leaf tier, *Sciaphila duplex* (Wlsh.). This leaf tier has been epidemic in aspen stands in Utah and southern Idaho since 1961. The area infested in 1964 remained at about 170,000 acres and, in general, the damage was less severe than in 1963. Intensity of damage increased, however, in localized areas on the Dixie and Fishlake National Forests in southern Utah. In these areas there was also a decided increase in the large aspen tortrix, *Choristoneura conflictana* (Wlk.). The damage from this insect is similar to that caused by the leaf tier. An additional decrease in the acreage infested is expected in 1965, but damage is expected to be heavy in localized areas.

F—509397

Aspen leaf tier and leaf roll tiedowns. Dixie National Forest, Utah.

Tussock moths, *Hemerocampa retusta* (Bdv.) and *Halisidota* spp. An increasing trend of *Hemerocampa retusta* (Bdv.) on bitterbrush near Reno, Nev., occurred in 1963. In 1964 epidemic populations were present over a wide area of bitterbrush ranges between Reno and Carson City, Nev. However, in areas sprayed experimentally with polyhedral virus in 1959, the 1964 population was materially reduced by the time the larvae had reached maturity.

Epidemic infestations of *Halisidota ingens* Edws. occurred in pinyon pine stands on the Dixie and Ashley National Forests, Bureau of Land Management lands, and the Uintah and Ouray Indian Reservation, Utah. The area infested did not increase appreciably over the several hundred acres infested last year; however, in 1964 there was a twofold increase in the number of trees infested by this tent-forming tussock moth. Limb killing occurred in all areas infested, and some trees probably will be

killed in 1965. The epidemic condition is expected to continue.

About 5,000 acres of juniper were defoliated by *Halisidota argentata subalpine* French on the Uintah and Curay Indian Reservation, Utah. Defoliation over the entire infestation averaged 30 percent and was as high as 75 percent in spots. Some pinyon pines were attacked also, but only in areas where the juniper foliage was heavily stripped.

Pitch nodule moth, *Petrova albicapitana* var. *arizonensis* (Hein.). Several thousand acres of pinyon pine were found infested with this pitch nodule moth. The most serious outbreaks occurred on Bureau of Land Management and Dixie National Forest lands in southern Utah and on the Ashley National Forest in eastern Utah. Lesser outbreaks occurred on the Henry Mountains near Hanksville, Utah, and south of Fort Duschene, Utah, on the Uintah and Curay Indian Reservation. In most areas there was a threefold increase in the moth population over last year. Moth larvae feeding inside the nodules killed the tips of branches. Insect damage of this type renders pinyon pine unfit for Christmas trees and also greatly reduces the nut crop by killing the cone-bearing branches. The epidemic is expected to continue, and in all likelihood damage will be more severe and widespread in 1965.

Engelmann spruce beetle, *Dendroctonus obesus* (Mann.). (*D. engelmanni* Hopk.). With two exceptions the Engelmann spruce stands of the Intermountain States are nearly free of bark beetle activity. One exception is an area on the Dixie National Forest, Utah, where there was a general increase in infestations. The bark beetles in this area moved

F–509393

Engelmann spruce stump sprayed for control of Engelmann spruce beetle. Uinta National Forest, Utah.

from scattered standing trees into logging debris and developed to epidemic proportions. Suppressive action initiated in the fall and winter of 1964 is expected to materially reduce the potential of this infestation.

Early in 1964 a population buildup of beetles was discovered in logging areas on the Bridger National Forest and adjoining Bureau of Land Management land in western Wyoming. Infested slash was scheduled for disposal in late 1964. Some chemical control action may be necessary in 1965.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. Damage caused by the Douglas-fir beetle declined sharply in 1963 and remained at a relatively low level in nearly all of the Intermountain States in 1964. On the Sublett Division, Sawtooth National Forest, Idaho, logging has been carried on steadily for the last few years in an effort to reduce the loss of sawtimber. This effort will continue.

Fir engraver, *Scolytus ventralis* LeC. In 1964 there was a definite increase in the number of true firs killed in the Intermountain States. In eastern Nevada and southern Utah, the damage in the last 2 years has been particularly severe. Stands infested with the fir engraver were suffering mortality also from an unknown agent. Infestations vary from a few acres to hundreds of acres in size. The majority of the affected stands are in rather inaccessible areas and have relatively low economic value. No control was attempted.

Other insects. The large-scale outbreak of aspen leaf miner, *Phyllocnistis populiella* Chamb., that has persisted in aspen stands of southeastern Idaho and western Wyoming for more than 14 years continued at epidemic levels in 1964. The western pine beetle, *Dendroctonus brevicomis* LeC., flared up in some ponderosa pine stands in southern Idaho. Mealybug epidemics continued on mixed conifers on the Payette National Forest, Idaho, and in Engelmann spruce stands on the Dixie National Forest, Utah. Tussock moths, except as reported above, were at a low level. Outbreaks of *Labops* sp. on planted crested wheatgrass, *Aroga websteri* Clarke on sagebrush, and *Pseudohazia* sp. on snowberry occurred in localized areas on valuable ranges. Heavy populations of spider mites, species unknown, were recorded on various conifers throughout the Intermountain States. They were particularly abundant in areas sprayed with DDT for control of spruce budworm in 1963. Pinyon needle scales that were abundant on pinyon pines the last few years declined.

NORTHERN ROCKY MOUNTAINS

By SCOTT TUNNOCK, Division of State and Private Forestry,
Missoula, Mont.

Conditions in Brief

Damage caused by the mountain pine beetles increased throughout the Northern Rocky Mountain Region. Chronic infestations resulting in losses of 3 to 14 percent of the stands persisted on portions of the Kaniksu, Coeur d'Alene, St. Joe, and Clearwater National Forests, Idaho. In addition, minor epidemics occurred in many ponderosa pine stands on the Lolo and Lewis and Clark National Forests, Mont. The Douglas-fir beetle declined on the Nezperce National Forest, Idaho, and on the Kootenai, Flathead, Lolo, and Gallatin National Forests, Mont. However, approximately 12,000 acres were seriously affected in the Swan Lake area on the Flathead Forest. Fir engraver epidemics diminished in stands of grand fir in northern Idaho, and most of the attacked trees were within only 81,500 acres northeast and southeast of Bigfork, Mont. The western balsam bark beetle was active in Yellowstone National Park, Wyo., and along the southern border of Montana.

The larch casebearer continued its spread throughout 8½ million acres of larch type in Idaho and Montana. A major epidemic of Douglas-fir tussock moth developed in 190,000 acres of grand and Douglas-fir type on the St. Joe National Forest, Idaho, and damage is expected to increase during 1965. In addition, about 4,800 acres of Douglas-fir near Kalispell, Mont., and 250 acres south of Polson, Mont., were heavily defoliated, and isolated infestations near private homes and on farm woodlots were found in six other areas.

The spruce budworm epidemic continued at a high level; defoliation was visible from the air on 2,189,590 acres. Damage to stands increased from 6,500 acres in 1963 to 166,607 acres in 1964 on the Nezperce National Forest, Idaho. Damage caused by the pine needle sheath miner occurred in many lodgepole and ponderosa pine stands, but its feeding was most noticeable on 53,000 acres in the northern half of the Flathead National Forest, Mont. Larch sawfly defoliation decreased. However, damage was visible on thousands of acres on the St. Joe and Clearwater National Forests, Idaho. Three other larch stands in Idaho, 1,500 to 4,000 acres in size, were damaged by a larch budmoth. A false hemlock looper defoliated several hundred acres of Douglas-fir on the National Bison

Range, Mont., and the Douglas-fir needle midge infested almost all of the Douglas-fir stands in Idaho and Montana. Epidemics of the forest tent caterpillar severely defoliated about 130,000 acres of birch, alder, willow, aspen, and cottonwood in northern Idaho.

Status of Insects

Mountain pine beetle, *Dendroctonus ponderosae* (Hopk.). (*D. monticolae* Hopk.). In general, damage by this bark beetle has been increasing in the northern Rocky Mountains since 1962. Most infestations have centered in mature stands of western white and ponderosa pine. However, lodgepole pine also has been seriously affected.

Beetle activity in 1964 was widespread in much of the ponderosa pine type on the Kootenai National Forest, Mont. In addition, an increase in infestations in ponderosa pine was noted along the northwestern part of the Lolo National Forest, and within the Snowy Mountains, Little Belts, and Castle Mountain areas on the Lewis and Clark Forest, Mont.

The mature stands of western white pine on several of the national forests in Idaho suffered severe losses. A significant increase in tree killing occurred, particularly on portions of the St. Joe and Clearwater Forests, where losses amounted to 5 to 14 percent of the stand. Chronic infestations were noted in the upper St. Joe River drainage, in numerous subdrainages of the Little North Fork and the North Fork of the Clearwater River, within the canyon block of the Clearwater Forest, and in subdrainages of the North Fork Coeur d'Alene River. In the canyon block area, some 75 million board feet of high-quality white pines are killed annually by blister rust and the beetle.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. Damage by this bark beetle declined materially from the peak loss rates of 1963. Areas on the Kootenai National Forest, Mont., that were heavily infested in 1963 contained only a few groups of killed trees in 1964. The number of dying trees within the Swan River drainage and South Fork Flathead River drainage, Mont., were also noticeably reduced. However, approximately 12,000 acres remained infested in the latter area, and several groups of dying trees, 10 to 100 trees per group, were noted in the area from Grangeville south to Slate Creek. Several light infestations persisted along the Gallatin River drainage, and occasional small groups of attacked trees were detected on the Lolo National Forest. In the latter area, infestations were most prominent in the Fish Creek, Thompson River, and Clearwater River drainages.

Fir engraver, *Scolytus ventralis* LeC. Damage by this engraver to grand and subalpine fir trees northeast of Bigfork, Mont., and along the east side of the Swan River to Goat Creek, Mont., has been increasing since 1961. During 1964, about 81,500 acres were heavily infested in the above area. Some remnants of a 1961 epidemic remained near Weippe, Idaho. Fir stands on the St. Joe and Nezperce National Forests, Idaho, contained occasionally attacked trees.

F–509409

Gallery pattern of the fir engraver in subalpine fir bark. Flathead National Forest, Mont.

Oregon pine ips, *Ips pini* (Say). (*I. oregonis* (Eichh.)). The number of pine trees killed annually by this beetle has decreased steadily since the epidemic in 1961. Ponderosa pine slash, cut in the spring of 1964, was heavily infested in several areas near Missoula, Mont. However, emerging beetles attacked only a few living trees in the surrounding area. Logging slash did cause three small ips infestations on the Salmon River Ranger District and one on

the Slate Creek District, Nezperce National Forest, Idaho. North of Frenchtown, Mont., a few groups of about 30 ponderosa pine trees were killed.

Western balsam bark beetle, *Dryocoetes confusus* Sw. Beetles in significantly destructive numbers have persisted for several years within Yellowstone National Park, Wyo. During 1964, 61 areas contained scattered group kills of 10 to 150 subalpine fir trees. Some groups of dying subalpine firs were found at higher elevations in forests along the southern border of Montana.

Larch casebearer, *Coleophora laricella* (Hbn.). This pest has spread rapidly since its discovery near St. Maries, Idaho, in 1959. The limits of infested larch in 1964 extended from the Washington border east to Paradise, Mont., and from the Canadian border south to the Middle Fork Clearwater River, Idaho. Although very heavy defoliation has occurred annually in some Idaho areas, no tree mortality has been observed. During 1964, 8,600 parasitic wasps (*Agathis pumilus* (Ratz.)) were liberated in six infested larch stands. It is anticipated that when the wasps are fully established, they can be collected from these sites and be transported to other infested areas. A pilot test with technical malathion applied by helicopter at about 8 fluid ounces (equivalent to 9.73 ounces malathion by weight) per acre was made in May 1964. Excellent results were obtained, and the methods thus show promise if aerial sprays are needed for direct control.

Douglas-fir tussock moth. *Hemerocampa pseudotsugata* McD. A major epidemic developed, and about 190,000 acres were infested between Troy and Plummer, Idaho. Grand fir and Douglas-fir trees were 70 to 90 percent defoliated within several thousand acres. Dam-

F–509410

Group killing of ponderosa pine by Oregon pine ips. Nezperce National Forest, Idaho.

age is expected to increase in 1965, and control is anticipated.

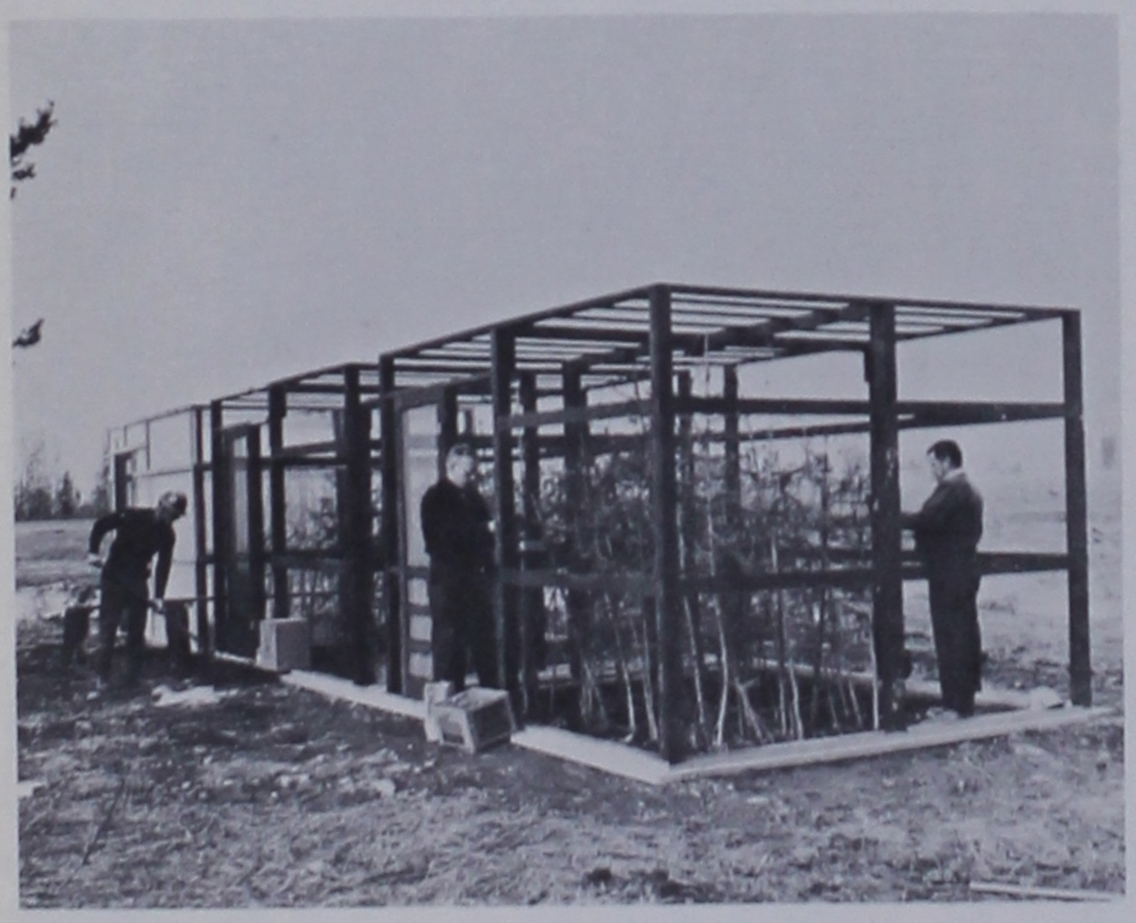
In 1963, 1,400 acres of Douglas-fir were defoliated near Kalispell, Mont. The infested area increased to about 4,800 acres in 1964. A polyhedrosis virus, which caused some tussock moth mortality in 1963, greatly reduced the population during 1964, and damage there is expected to be much less in 1965. In addition, the isolated infestations near private homes and on farm woodlots in Bigfork, Mont., and Coeur d'Alene, Hayden Lake, Rathdrum, Bonners Ferry, and Copeland, Idaho, are also expected to decrease in 1965.

Spruce budworm, *Choristoneura fumiferana* (Clem.). Spruce budworm epidemics have persisted in northern Idaho and in Montana for more than 14 years. For the past 6 years, information collected from permanent plots in chronically defoliated areas indicates the infestation status generally has remained static.

The following tabulation contains data that summarize infestation trends during 1963 and 1964:

	1963	*1964*
Defoliation, percent	35.00	35.00
Egg masses per M sq. in. of foliage	9.50	11.90
Egg mass parasitism, percent	.00	1.10
New foliage growth, inches	.93	.76
New foliage destroyed, inches	.32	.26
Net length of new foliage, inches	.61	.50

During 1964, defoliation on 2,189,590 acres was visible from the air. This was 177,886 more acres than was detected in 1963. Most of this increase was on the Nezperce National Forest, Idaho. The infestation there increased from 6,500 to 166,607 acres. Additional stands of timber are also being infested toward the southeast on the Custer National Forest, Mont.

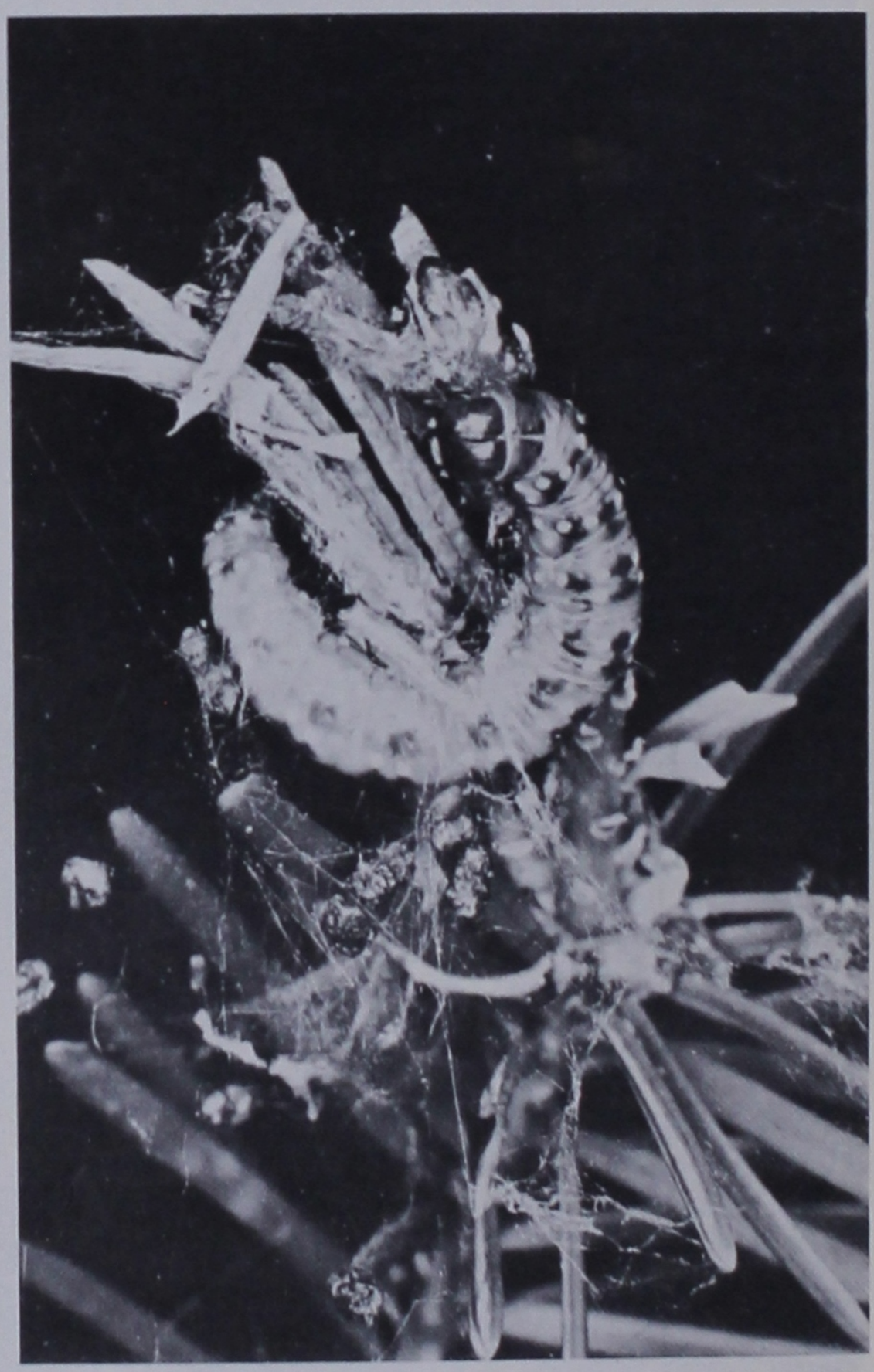


F–509411

Insect cages to be used in rearing parasites of the larch casebearer for release in infested larch stands in Idaho and Montana.

Based on the number of egg masses per thousand square inches of foliage, the percentage of defoliation in 1965 apparently will approximately equal that of 1964.

Pine needle sheath miner, *Zelleria haimbachi* Busck. Damage by this pest was detected in most lodgepole and ponderosa pine stands in Idaho and Montana. In 1963, it defoliated about 168,000 acres of lodgepole pine trees on the Flathead National Forest, Mont. However, defoliation on the Flathead during 1964 was reduced to 53,000 acres. One extensive infestation occurred east of West Glacier and another west of Whitefish. A remnant of last year's epidemic was still apparent near Elbow Lake in the Swan River drainage, and about 2,000 acres was reported to be lightly defoliated along the southwest border of Yellowstone National Park, Wyo. Ponderosa pine stands along the west side of the Bitterroot River drainage have been infested for several years. During 1964,



F–509413

Mature spruce budworm larvae feeding on foliage of Douglas-fir. Nezperce National Forest, Idaho.

about 4,000 acres west of Stevensville, Mont., suffered rather heavy defoliation.

Larch sawfly, *Pristiphora erichsonii* (Htg.). The number of infested areas and amount of larch timber defoliated by the larch sawfly in the Northern Rocky Mountains seemed to have reached a peak during 1963. However, four isolated infestations, 150 to 700 acres in size, were detected east of Weippe and northeast of Pierce, Idaho, and infestations persisted on 24,000 acres of the St. Joe National Forest, Idaho.

A larch bud moth, *Zeiraphera* sp. The number of larch stands defoliated by what is believed to be *Z. griseana* (Hbn.) increased in the northwestern forests of Montana and Idaho. Defoliation of a total of 2,000 acres was observed in eight infested areas west of Porthill, Idaho. West of Troy, Mont., more than 4,000 acres were infested. Defoliation was visible from the air on 1,500 acres at the head of Ninemile Creek, east of Superior, Mont., and ground surveys showed that damage also extended to the northwest for 7 more miles.

F–509414

The larch sawfly defoliated stands of western larch at several localities in Idaho.

A larch looper, *Semiothisa* sp. Many sections of larch in Beaver and Little Beaver Creek drainages, Lolo National Forest, Mont., were heavily defoliated during 1963. Damage symptoms resembled those made by *Zeiraphera griseana* (Hbn.), but pupae collected from the duff in June 1964 produced moths that resembled *S. sexmaculata* Pack. Damage to the stands was very light. Looper larvae were also found on larch foliage at the head of Ninemile Creek, Lolo National Forest.

A false hemlock looper, *Nepytia* sp. Damage by this insect was recorded for the first time in Idaho and Montana in 1963, when it defoliated about 375 acres of Douglas-fir at three locations on the National Bison Range, Moiese, Mont. Defoliation could not be seen from the air on one of these areas during 1964, but it was heavier and had spread on the other two. Since its discovery on the National Bison Range in 1963, moths and egg masses have been observed in many northwestern Douglas-fir stands.

Douglas-fir needle midges, *Contarinia pseudotsugae* Condr. and *C. constricta* Condr. Since 1957, these midges have infested most of the Douglas-fir stands in northern Idaho and Montana. Damage to current needles decreased somewhat on the Nezperce and Clearwater National Forests, Idaho, but it increased along the Kootenai and Fisher River drainages, Mont. Midge damage is apparent, but light, in other stands throughout the northern Rockies.

Feeding is particularly harmful to Christmas trees because needles mined by the larvae during the summer begin to fall by October.

Forest tent caterpillar, *Malacosoma disstria* Hbn. An epidemic appeared during 1963 in northern Idaho along river bottoms. The caterpillars ate birch, alder, willow, aspen, and cottonwood foliage within 116,000 acres. In Idaho during 1964 more than 13,000 acres were defoliated along the Priest River drainage, and from Careywood north to Bonners Ferry about 100,000 acres were ravaged again. Near Kingston and along the north fork of the Coeur d'Alene River drainage, more than 6,000 acres were heavily defoliated.

Epidemics of this moth usually last 2 to 3 years in Montana and Idaho. Damage is expected to begin decreasing in 1965.

F–509415

Douglas-fir needle midge larvae inside gall on Douglas-fir needle. Orofino, Idaho.

F–509416

The forest tent caterpillar defoliated birch, alder, willow, aspen, and cottonwood trees on many acres along the Priest River drainage, Idaho.

CENTRAL ROCKY MOUNTAINS

By A. E. LANDGRAF, JR., and S. W. MESO, Division of Timber Management
Denver, Colo.

Conditions in Brief

For the fourth consecutive year the Black Hills beetle was the most serious forest insect problem in the Central Rocky Mountains, and land managers treated more than 299,000 beetle-infested pines in control operations. The serious outbreak in the Black Hills of South Dakota and Wyoming was checked through concerted efforts of Federal, State, and private land managers. An outbreak in the Big Horn Mountains, north-central Wyoming, was also checked by a joint program. In Colorado, these land managers prevented beetle populations from increasing along the Front Range through effective suppression programs. Over on the western slope, an outbreak was suppressed on the Grand Mesa-Uncompahgre National Forest by salvaging the infested trees. A new outbreak of the Black Hills beetle was discovered on the Medicine Bow National Forest in south central Wyoming.

Land managers rediscovered in 1964 that tree disposal was extremely effective in suppressing bark beetles. More than 172,000 beetle-infested pines were cut and salvaged or piled and burned. Chemical suppression was also made more effective. All of the infested trees chemically treated were first cut. Thanks to the modern chain saw, cost of felling the trees was only a small part of total treatment cost.

A potential outbreak of the Engelmann spruce beetle was discovered in the Green Horn Mountains on the San Isabel National Forest. Beetle broods in windthrown trees pose a threat to several thousand acres of overmature Engelmann spruce. A trap tree program will be used in an effort to prevent these beetles from spreading into the standing trees. Elsewhere in

Colorado, Engelmann spruce beetle populations remained at endemic levels.

The scope and severity of spruce budworm infestations in Colorado forests increased somewhat over a year ago. Defoliation heavy enough to be seen from the air was observed in 97,800 acres of fir type. The most active infestation was along the eastern slope of the Sangre de Cristo Range, San Isabel National Forest.

Status of Insects

Black Hills beetle, *Dendroctonus ponderosae* Hopk. Land managers were successful in reduring the serious Black Hills beetle outbreak in the Black Hills in South Dakota and Wyoming. More than 238,000 beetle-infested trees were either salvaged (34,000), piled and burned (118,000), or chemically treated (86,000). Participating in the suppression program were Home-stake Mining Co., Anaconda Co., Deadbroke and Bald Mountain Mining Cos., South Dakota and Wyoming State Forest Services, Bureau of Land Management, National Park Service, and the U.S. Forest Service. An intensive suppression program is planned for 1965 to reduce the beetles to endemic numbers. This will require treating about 79,000 infested trees.

The Bureau of Land Management, Wyoming State Forest Service, and the U.S. Forest Service prevented the Black Hills beetle outbreak in the Big Horn Mountains from increasing in scope and intensity by burning or chemically treating more than 16,000 infested trees.

In Colorado, the State Forest Service, Bureau of Land Management, National Park Service, and the U.S. Forest Service suppressed Black Hills beetle outbreaks along the Front Range Mountains. More than 40,000 beetle-infested pines were either burned or chemically treated.

On the western slope of Colorado, the Forest Service checked a beetle outbreak on the Uncompahgre Plateau by salvaging about 1,500 beetle-infested trees.

A Black Hills beetle infestation was discovered on the Medicine Bow National Forest in south-central Wyoming. The infestation, about 600 acres in size, occurred on Pennock Mountain northeast of Saratoga, Wyo. Both lodgepole and limber pine were killed. This is the first reported activity by this beetle in this area since the 1932–39 outbreak that destroyed more than 400,000 trees before being brought under control. In general, the infestation was classified as light. However, it will be carefully watched in 1965.

Mountain pine beetle, *Dendroctonus ponderosae* Hopk. (*D. monticolae* Hopk.). Infestations on the Wind River District of the Shoshone National Forest in northwest Wyoming were kept in check during 1964 by treating 3,500 infested lodgepole pines. Farther to the north, outbreaks in limber pine on the Belknap Creek drainage southwest of Cody, Wyo., have run their course. Woodpecker predation of beetle broods is partly responsible for the decline in infestations in this area. Elsewhere in northwest Wyoming east of the Continental Divide, beetle populations were at endemic levels.

Engelmann spruce beetle, *Dendroctonus obesus* (Mann.) (*D. engelmanni* Hopk.). Englemann spruce beetle populations in the Central Rocky Mountains are seldom really low because the pest maintains its numbers by breeding in wind-thrown spruce. In 1964 a potentially serious infestation was discovered on the Green Horn Mountains of the San Isabel National Forest. A severe windstorm in December 1962 blew down several thousand Engelmann spruce scattered over approximately 12,000 acres of overmature spruce type. All the down trees contained large numbers of beetles in 1964 that will emerge in June and July of 1965. To combat the hazards, plans are being made for a trap tree control program. Several patches of trees will be cut to serve as traps and after beetle flight will either be salvaged or piled and burned. Plans are also underway to reduce the insect hazard in this area by harvesting the overmature Engelmann spruce. Twenty million board feet of spruce has already been sold adjacent to the blowdown.

The Engelmann spruce beetle continued at an endemic level throughout other spruce forests in the Central Rocky Mountains.

Spruce budworm, *Choristoneura fumiferana* (Clem.). Spruce budworm populations increased sharply along the eastern slope of the Sangre de Cristo Mountains, San Isabel National Forest, Colo. The infestation was estimated to involve 80,000 acres. Egg mass surveys made in August indicated that defoliation in this area will be moderate to heavy in 1965. In other forest areas of Colorado, spruce budworm populations remained endemic. Defoliation, heavy enough to be seen from the air, covered 97,800 acres or about two times more than the number of acres reported in 1963.

Pandora moth, *Coloradia pandora* Blake. Populations of this important defoliator declined on the Medicine Bow, Roosevelt, and Routt National Forests, Colo. and Wyo., in 1964. Defoliation was not heavy enough to be seen except by close inspection of the infested trees. Damage to lodgepole pine stands is expected to be light in 1965.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. Douglas-fir beetle populations increased in southern Colorado. Light to moderate tree killing was reported throughout the

Douglas-fir type in the San Juan National Forest. The heaviest centers of infestation were located on Devil Mountain and on the Little Sand Creek, Sand Creek, and Mosca Creek drainages. The infestation in the Powderhorn area southwest of Gunnison also increased in 1964. Elsewhere in the Central Rocky Mountains, beetle populations remained endemic.

Western balsam bark beetle, *Dryocoetes confusus* Sw. This insect did little damage in 1964. Populations throughout the spruce fir type in Colorado and Wyoming are expected to remain low in 1965.

Oregon pine ips, *Ips pini* (Say). (*I. oregonis* (Eichh.)). The Oregon pine ips has been a periodic problem in the Black Hills of South Dakota and Wyoming for at least 30 years. During years of below average precipitation, it has been a serious problem in thinning programs. Beetle populations build up rapidly in slash and then infest crop trees. In 1964, about 9,200 crop trees in experimental thinning plots on the Black Hills Experimental Forest were sprayed with DDT to prevent attacks. The treatment was successful. In general, populations of the pest were low in 1964 and are expected to remain so in 1965.

Great Basin tent caterpillar, *Malacosoma fragile* (Stretch). Defoliation by this caterpillar increased in southern Colorado in 1964. Leaves of aspen on several hundred acres in the Cumbres Pass area, Rio Grande National Forest, were completely stripped. Infestations of lesser scope and severity were also found on the San Isabel and San Juan National Forests. The aspen stands along the west fork of the Cimarron River, Grand Mesa-Uncompahgre National Forest, were only lightly defoliated.

Leaf beetle, *Chrysomela* sp. Aspen and birch stands in the Black Hills of South Dakota were again heavily defoliated by an aspen leaf beetle. In south-central Wyoming, this insect also stripped leaves off the cottonwoods and willows along Brush Creek, Medicine Bow National Forest.

SOUTHWESTERN STATES [1]

By D. D. LUCHT and J. F. CHANSLER, Division of Timber Management,
Albuquerque, N. Mex.

Conditions in Brief

Insect activity increased in the Southwest in 1964. An Engelmann spruce beetle infestation erupted and killed nearly 2,000 Engelmann spruce trees on Mt. Taylor in central New Mexico. The spruce budworm infestation on the Lincoln National Forest in southern New Mexico spread from 50,000 to 90,000 acres. The one on 350,000 acres of non-Federal land in northern New Mexico intensified. New outbreaks of Arizona five-spined ips and a pine bark beetle caused serious damage to stands of ponderosa pine in several areas of Arizona and New Mexico. The white fir needle miner, previously unrecorded in the Southwest, damaged several thousand acres of white fir on the Kaibab Plateau of northern Arizona. The Great Basin tent caterpillar defoliated many stands of aspen in small areas of Arizona. The Black Hills beetle was less troublesome than expected in the Manzano Mountains of central New Mexico. Infestations of Douglas-fir beetle remained static at high levels throughout the region. The pinyon needle scale was again active at Grand Canyon National Park.

Control was carried out against the Engelmann spruce beetle, a pine bark beetle, the Nevada buck moth, and two species of tent caterpillars. Except for the Engelmann spruce beetle projects, control efforts were directed against infestations in high-use recreation areas.

Status of Insects

Engelmann spruce beetle, *Dendroctonus obesus* (Mann.). (*D. engelmanni* Hopk.). A serious outbreak of Engelmann spruce beetle killed 2,000 overmature Engelmann spruce trees on Mount Taylor near Grants, N. Mex. Extremely high broods and lack of natural control factors indicated a sharply increasing population. Cultural measures were immediately started for control. The 7-year-old infestation on the Carson National Forest near Taos, N. Mex., declined in extent and intensity. This decline resulted from continued logging of infested cull logs and slash during the last 4 years. An infestation at the Snow Bowl Ski Area, Flagstaff, Ariz., remained active.

Spruce budworm, *Choristoneura fumiferana* (Clem.). The most aggressive budworm infestation occurred on the Lincoln National Forest, N. Mex., where it spread from 50,000 to 90,000 acres. An infestation on the Gila National Forest, N. Mex., remained at 40,000 acres. Other infestations on approximately 350,000 acres of non-Federal land near Chama and Cimarron, N. Mex., intensified. Budworm populations, which were calculated from egg mass densities, were extremely low in areas sprayed in 1962 and 1963.

[1] Includes all forested lands in Arizona and New Mexico and National Park Service land in southern Colorado and western Texas.

Arizona five-spined ips, *Ips lecontei* Sw. Two new infestations of this pest were reported. About 15 groups of trees, with 20 to 50 dead or dying trees per group, were found south of Prescott, Ariz. Four groups, totaling about 150 trees, were killed at Oak Creek Canyon Recreation Area, Sedona, Ariz. Sedona is the most northern point recorded for this Mexican species. Measures were undertaken to control the latter infestation.

F—509191

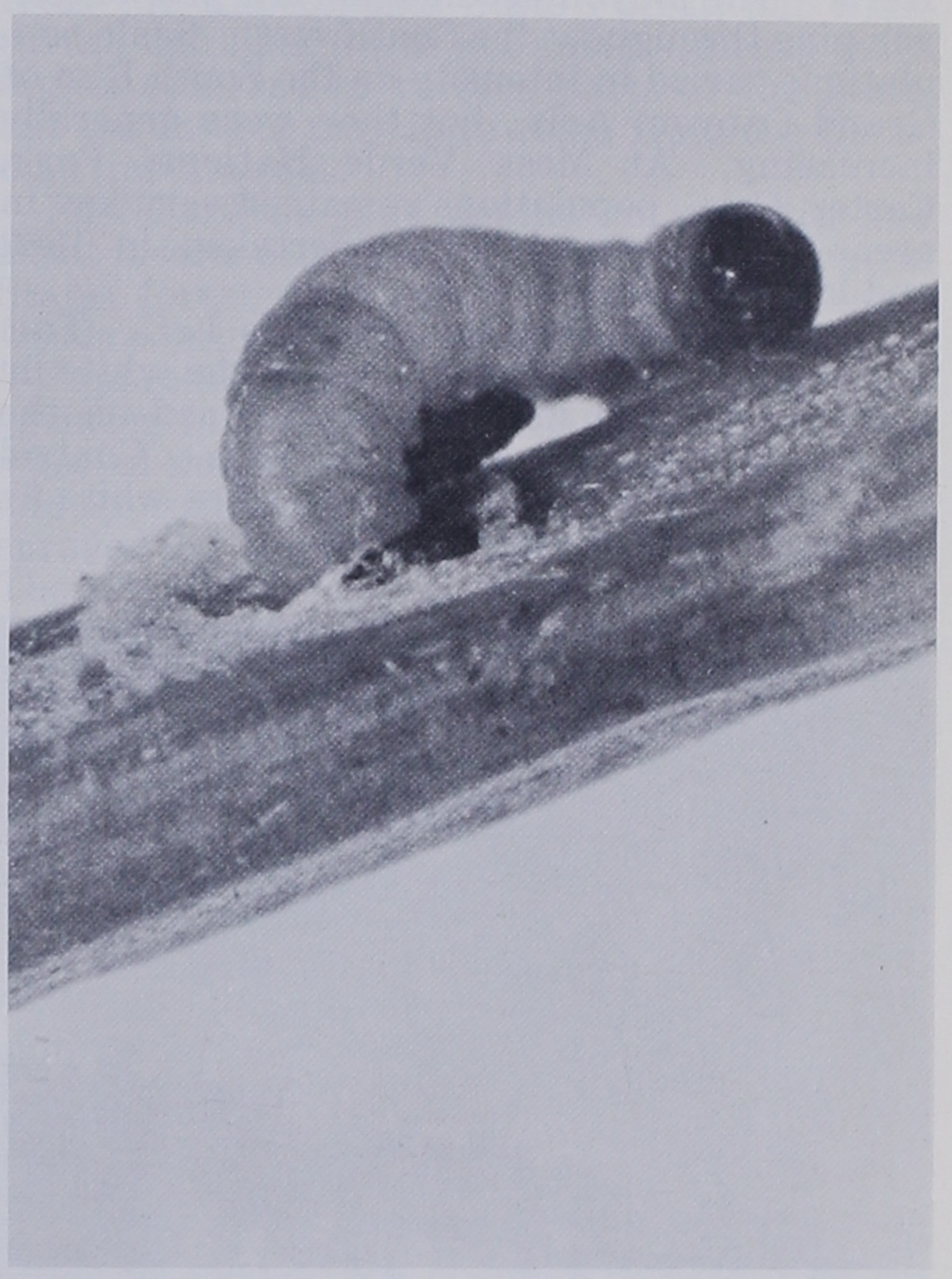
Ponderosa pines killed by the Arizona five-spined ips. Prescott National Forest, Ariz.

Oregon pine ips, *Ips pini* (Say). (*I. oregonis* (Eichh.)). This insect killed 400 to 600 pole-size ponderosa pine at Ruidoso, N. Mex. A similar outbreak appeared in the nearby Capitan Mountains. This was the first year since 1960 that this pest caused significant tree mortality in these areas.

Roundheaded pine beetle, *Dendroctonus adjunctus* Blandf. (*D. convexifrons* Hopk.). An outbreak in approximately 200 ponderosa pines was chemically treated at Riggs Lake Recreation Area, Safford, Ariz. The infestation on the Lincoln National Forest near Ruidoso, N. Mex., increased slightly.

White fir needle miner, *Epinotia meritana* Hein. This pest, previously unrecorded in the Southwest, was found infesting several thousand acres of white fir on the Kaibab Plateau of northern Arizona. Evaluation of the infestation indicated a light but increasing population. The infestation is expected to spread.

Great Basin tent caterpillar, *Malacosoma fragile* (Stretch). The Great Basin tent caterpillar continued to jeopardize scenic, recreation, and watershed values in small areas throughout aspen stands. In the scenic and recreation areas of the Kaibab Plateau and the Pinal and Huachuca Mountains of Arizona, defoliation was not only unsightly, but the caterpillars were also a nuisance to visitors. Heavy populations of this pest occurred throughout the aspen stands on Navajo Mountain near Tuba City, Ariz. The already scarce supply of water for livestock is being contaminated by the migrating, food-seeking larvae. In northern New Mexico the population centers shifted; about 100,000 acres remained infested.



F—509193

White-fir needle miner emerging from one of the six needles it will normally destroy in a single season. Kaibab Plateau, Kaibab National Forest, Ariz.

An infestation which occurred along the approach road to the North Rim of Grand Canyon was sprayed with malathion with only partial success. A pilot test was conducted against a *Malacosoma* species on cottonwood and willow near Tucson, Ariz., using a native polyhedrosis virus fortified with the bacterium *Bacillus thuringiensis* Berliner. The results of this test are being determined.

Black Hills beetle, *Dendroctonus ponderosae* Hopk. The outbreak in ponderosa pine on the Mountainair District, Cibola National Forest, near Albuquerque, N. Mex., was not as serious as expected. Studies in the area re-

vealed the attacks were unsuccessful on more than half of the trees hit in 1963. Concern remains regarding the infestation, and observation will continue.

Douglas-fir beetle, *Dendroctonus pseudotsugae* Hopk. Killing of Douglas-fir was heavy on the Kaibab National Forest, especially on Bill Williams Mountain, near Williams, Ariz. Logging was used, where feasible, for control.

Pinyon needle scale, *Matsucoccus acalyptus* Herb. The pinyon needle scale is a pest of pinyon pine throughout the Southwest. Scale populations varied in intensity on the South Rim of Grand Canyon, Ariz., but they were generally increasing. At Mesa Verde National Park, Cortez, Colo., populations remained very low in areas where control was undertaken in 1962 and 1963.

Fir engraver, *Scolytus ventralis* LeC. This pest caused only minor damage to the white fir stands. A small infestation remained on the Mogollon Rim near Flagstaff, Ariz. Control was limited to removal of overmature white fir near high-use recreational areas.

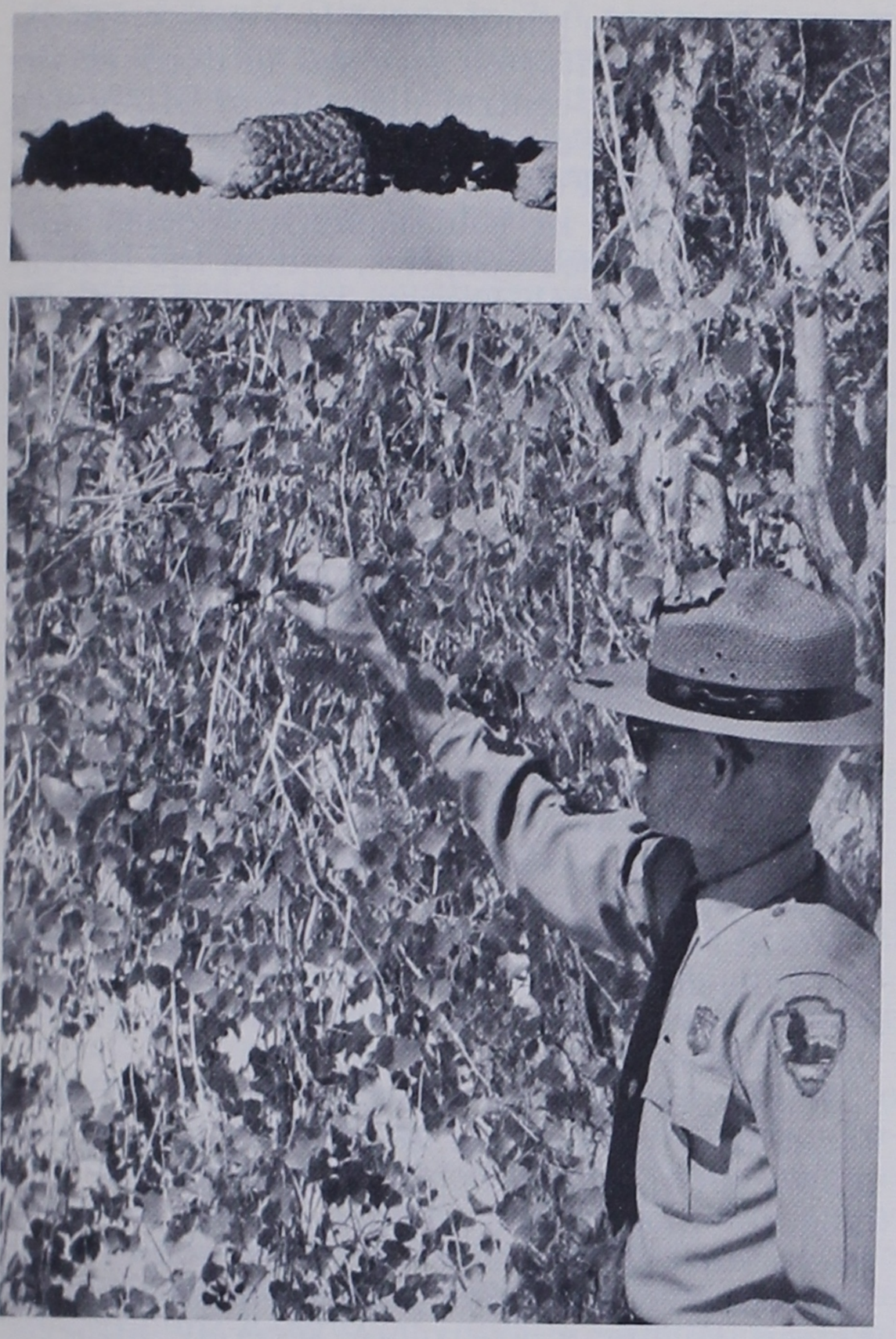
Western balsam bark beetle, *Dryocoetes confusus* Sw. Tree mortality of significance continued in most stands of corkbark and alpine fir in New Mexico. Tree killing was also increasingly evident in the true fir stands of northern Arizona.

Nevada buck moth, *Hemileuca nevadensis* Stretch. This voracious defoliator occurred in outbreak numbers on native cottonwood at White Sands National Monument, near Alamogordo, N. Mex. The infestation was suppressed with malathion and sevin sprays, applied with high-volume ground equipment before host trees were stripped. This was the only known infestation of this moth on cottonwood.

Grass plant bug, *Labops hesperius* Uhler. About 1,200 acres of severely infested crested wheatgrass at Cuba, N. Mex., were sprayed to control this plant bug. This represents about 15 percent of the total infested area. Malathion was applied by helicopter. Control results were excellent.

F—509192

Severe killing of Douglas-fir by the Douglas-fir beetle. Bill Williams Mountain, Kaibab National Forest, Ariz.



F–509190

National Park Service Ranger examines black, spiny Nevada buck moth caterpillars on cottonwood tree. White Sands National Monument, N. Mex.

LAKE AND CENTRAL STATES

By D. O. VANDENBURG,[1] Division of State and Private Forestry,
Milwaukee, Wis.

Conditions in Brief

Conifer defoliators were the most important of the damaging insects in the Lake and Central States. For the second year, population levels of the spruce budworm have declined in the spruce and fir stands of northeastern Minnesota, but the outbreak of the jack pine budworm became general and now extends throughout most of the jack pine areas of northern Lower Michigan, of Polk and Burnett Counties, Wis., and in scattered areas in the central and north-central parts of Minnesota. The pine tussock moth was reported at outbreak levels in portions of Douglas County, Wis. Scattered larval populations of the forest tent caterpillar were reported along the northern boundary of Minnesota and from the Kabetogama State Forest, but widespread defoliation was not noted. Heavy moth flights occurred in various parts of the State, but the insects may have come from the Canadian infestations.

Miscellaneous pine defoliators and tip and shoot insects caused some concern in the Central States forests, but living tree borers of hardwoods continued to be the number-one problem.

Suppression activities by public and private agencies in the Lake and Central States were directed mainly against the pine tussock moth, and approximately 8,300 acres of jack pine were sprayed by fixed-wing aircraft in Wisconsin. The remaining suppression activities were limited to the field testing of malathion, cygon, and zectran for control of jack pine budworm, and malathion for control of the Saratoga spittlebug—all on the Huron-Manistee National Forest, Mich.

Status of Insects

Spruce budworm, *Choristoneura fumiferana* (Clem.). In spite of reported high adult populations in portions of the Superior National Forest, Minn., aerial surveys showed a general decline in both extent and intensity of defoliation. The apparent population decline that was noted last year appeared to be continuing; although areas of heavy and severe defoliation in stands of balsam fir persisted on parts of the Echo and Gunflint trails and in the vicinity of the Kawishiwi Experimental Forest.

The large number of budworm-killed trees on the Superior National Forest has increased the fire hazard and prompted the construction of firebreaks and an intensification of aerial fire patrol.

No control has been proposed on Federal, State, or private lands this year because of an unfavorable cost-benefit and adverse effects evaluation.

Jack pine budworm, *Choristoneura pinus* (Free.). A general infestation by this insect extends throughout most of the jack pine areas of northern Lower Michigan. Although defoliation was evident over a much wider area than in 1963, feeding was generally restricted to the new needles and the intensity of defoliation was less. Most areas that were severely defoliated

[1] Information compiled from reports submitted by Leo Abrahamsen, Minn. Dept. Agr.; Paul R. Flink, Mich. Dept. Conserv.; Ramon Gass, Mo. Conserv. Comm.; M. K. Idleman, Ohio Dept. Nat. Resources; Donald W. Renlund, Wis. Conserv. Dept.; Prof. R. G. Rennels, Univ. Ill.; Robert Doerner, Richard Fowler, Imants Millers, Charles O. Rexrode, Steve O. Ryan, Arland Valcarce, U.S. Forest Serv.

in 1963 showed little or no signs of defoliation this year. The results of egg surveys in affected areas indicate high population levels for 1965 unless natural control factors intervene.

The trend of infestations of this insect appears to be upward in northwest Wisconsin, and control is planned on 12,000 acres. Field tests of some of the less persistent insecticides are planned in an effort to find suitable alternatives to DDT.

Pine tussock moth, *Dasychira plagiata* (Wlk.). Approximately 8,300 acres of jack pine stands were successfully sprayed in May to control infestations of the pine tussock moth on State and private land in Wisconsin. However, egg counts and larval surveys in adjacent areas indicate a serious threat to about 12,000 acres of jack and red pine.

With the exception of a small localized outbreak on the Chequamegon National Forest, Wis., where 1965 defoliation is expected to be light, there were no reports of this insect elsewhere in the Lake States.

Forest tent caterpillar, *Malacosoma disstria* (Hbn.). The forest tent caterpillar poses a definite threat to the aspen and other hardwood stands of northern Minnesota and Michigan. Scattered larval populations were reported along the northern boundary of Minnesota. In addition, heavy moth flights were reported and light trap catches increased on the Chippewa National Forest. The majority of the insects caught in traps may have come from the Canadian infestation.

Cooperative egg mass surveys are being conducted throughout Minnesota to determine whether an increase in extent and severity of defoliation can be expected in 1965.

Approximately 5,000 acres of Federal, State, and private lands have been proposed for field testing a rather wide gamut of the less persistent insecticides against this insect. If widespread control becomes necessary, it is hoped that a substitute for DDT will be available.

Saratoga spittlebug, *Aphrophora saratogensis* (Fitch). With the exception of portions of the Nicolet and Huron-Manistee National Forests, Wis., populations of this insect are generally at low levels.

Control with one-half pound DDT, applied by backpack mistblower, was effective on 42 acres of red pine plantation in Menominee and Oneida Counties, Wis. Control, equal to 1 pound per acre of DDT, was achieved with 1 pound and one-half pound malathion applied by mistblower on the Huron-Manistee National Forest. Pilot tests with malathion, applied by helicopter, are planned for 1965.

Pine sawflies, *Neodiprion* and *Diprion* spp. In general, damage caused by the various pine sawflies in the Lake and Central States was light. Roadside plantings of jack pine were defoliated by *Neodiprion lecontei* (Fitch) in the central and east-central districts of Minnesota and on the Cut Foot Sioux District of the Chippewa National Forest. In Illinois and Michigan, especially in southeastern Alcoma and northeastern Iosco Counties, and on the Huron-Manistee National Forest, increased activity was reported after several years of low population levels. Scattered light feeding on jack pine by the red pine sawfly, *N. nanulus nanulus* (Schedl), was reported from the Chippewa and Manistee National Forests. A surprisingly low second generation of the introduced pine sawfly, *Diprion similis* (Htg.), in the east-central and central districts of Minnesota was generally attributed to a high degree of cocoon parasitism. High-level populations of the European pine sawfly, *N. sertifer* (Geoff.), were present in most counties in the southern third of Lower Michigan. The European spruce sawfly, *D. hercyniae* (Htg.), was found in Wisconsin this year—a new State record. Surveys are planned to determine the statewide distribution and impact. There was spread of the Virginia pine sawfly, *N. pratti pratti* (Dyar), on private land in Illinois.

White-pine weevil, *Pissodes strobi* (Peck). Damage to plantations of red, white, and jack pine occurred throughout the Lake States. Red pine, the most widely planted species, seems to be more heavily hit each year. For some reason yet unknown, jack pine plantations in northern Lower Michigan are more severely attacked than in the Upper Peninsula. The incidence of attack on the Superior National Forest, Minn., increased 3 percent over last year.

Four hundred and eighty acres of infested jack pine in northern Lower Michigan were sprayed, using backpack sprayers. Chemical control may be needed in certain red pine plantations on the Huron-Manistee and Nicolet National Forests within the next 5 years.

Pine tortoise scale, *Toumeyella numismaticum* (P. & M.). There were reports that this insect, alone and in association with the black pine leaf scale, *Aspidiotus californicus* Coleman, are becoming more severe each year. Rather high populations were found on the Nicolet National Forest, Wis.; the Ottawa, Hiawatha, Huron-Manistee National Forests, Mich.; and within the boundaries of the 1962 jack pine budworm spray project on the Chippewa National Forest, Wis.

Red-pine cone beetle, *Conophthorus resinosae* (Hopk.). The growth of jack pine was reported being seriously hindered throughout most of the Huron-Manistee National Forest, Mich., by the bud and shoot feeding of this insect. There is a possibility that more than one beetle species is involved because their life his-

tories differ. Damage to 3–0 red pine nursery stock is occurring with increased frequency and causes concern in the Chittenden Nursery. Elsewhere in the Lake and Central States, populations and damage levels were variable.

Nantucket pine tip moth, *Rhyacionia frustrana* (Comst.). Pine plantations continue to be attacked in the southern part of Illinois, the southeast Ozarks of Missouri, and National Forest lands of the Central States, but less severely than in 1963. In Missouri there were some indications that population levels may rise in 1965 unless there is a repeat of the 1962–63 winter "setback."

Ips. (pine engraver), *Ips* spp. In the Lake and Central States, damage from ips beetles remained localized in scattered pockets with occasional reports of larger infestations resulting from porcupine, snow, and logging damage. Spot kills of shortleaf pine were reported from Tell City, Ind., where there also had been a buildup in red pine logging slash. Ground checks made in conjunction with a recent aerial survey of pine plantations, Shawnee National Forest, Ill., disclosed 1,500 shortleaf pines attacked by *Ips,* most in connection with primary attack by *Fomes annosus,* a fungus disease.

Other insects. Moderate to heavy attacks to oaks by the carpenterworm, *Prionoxystus robiniae* (Peck), and the red oak borer, *Romaleum rufulum* (Hald.), were reported from many locations throughout the Central States. These insects continued as the number-one insect pests of southern hardwood forests. Damage to red pine from the European pine shoot moth, *Rhyacionia buoliana* (Schiff.), declined. Low-level populations of the larch sawfly, *Pristiphora erichsonii* (Htg.), were present on the Chippewa, Ottawa, and Superior National Forests in Minnesota and Wisconsin. However, there was an increase in the degree of defoliation in the eastern Upper Peninsula of Michigan and in some parts of Minnesota. The black turpentine beetle, *Dendroctonus terebrans* (Oliv.), was reported from Missouri in conjunction with lightning strikes, *Fomes annosus,* and mechanical injury.

Cankerworms, *Alsophila pometaria* (Harris) and *Paleacrita vernata* (Peck), occurred in outbreak numbers for the third year in parts of Minnesota. Chemical control was undertaken in the metropolitan area of the Twin Cities and surrounding communities. These insects also caused considerable annoyance in several urban areas of Lower Michigan.

Tree mortality caused by the pine root collar weevil, *Hylobius radicis* (Buch.), continued to increase in Michigan. The major problem was centered in Scotch pine plantations that have grown past Christmas tree size, and in mixed red and jack pine plantations.

The area of defoliation from the walkingstick, *Diapheromera femorata* (Say), has decreased steadily for the past decade in Ogemaw County, Mich. Population levels in the Marinette County infestation in Wisconsin also decreased in 1964.

SOUTHERN AND SOUTHEASTERN STATES

By W. D. BUCHANAN,[1] Division of State and Private Forestry,
Atlanta, Ga.

Conditions in Brief

The southern pine beetle was endemic throughout most of the Southern and Southeastern States early in 1964. However, as the season progressed, it became epidemic in the upper Piedmont of North Carolina, on the Francis Marion National Forest in eastern South Carolina, and on the Andrew Pickens and Tyger Districts in western South Carolina. High populations also occurred in the Homochitto National Forest, Miss., and threatened in Talladega County, Ala., and in Rabun County, Ga. Infestations in Texas were generally low. However, in a few spots in Hardin County, they increased in the summer but declined in the fall. In Louisiana the beetles were active early in the year in the West Bay area in Allen Parish, but populations declined in the fall.

Ips beetles caused considerable damage in portions of the Piedmont areas of North Carolina and South Carolina. In addition, ips populations built up in central Alabama and Georgia after a dry, hot period in the spring, but subsided in July when abundant rain started to fall.

The black turpentine bettle continued to kill trees in all parts of the South and Southeast. Although infestations were localized, in the aggregate a considerable number of trees were affected.

Pales weevils were abundant in young pine plantations in the east coastal area of North Carolina.

The balsam woolly aphid continued to cause extensive killing of Fraser fir in the mountains of North Carolina. New areas of aphid infestation were found on Roan Mountain, Grandfather Mountain, Great Smoky Mountains National Park, and a 2-acre plantation on the Blue Ridge Parkway.

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[1] Report compiled from information submitted by the Zone Leaders at Asheville, N.C.; Macon, Ga.; Alexandria, La.; and State Pest Control personnel.

The elm spanworm ceased to be a problem in 1964. An egg parasite, *Telenomus alsophilae* Vier., was considered a major factor in the collapse of the epidemic.

Fall webworm populations increased in parts of Arkansas.

The loblolly pine sawfly defoliated about 2,500 acres of loblolly pine in the vicinity of Georgetown and Urania, La., and fed upon approximately 679,200 acres in Arkansas.

Status of Insects

Southern pine beetle, *Dendroctonus frontalis* Zimm. The southern pine beetle was endemic in most of the Southern and Southeastern States during the first part of 1964. Beetle activity remained at a low level on the Andrew Pickens and Tyger Districts of the Sumter National Forest until midsummer at which time epidemic levels were reached. Activity increased on the Francis Marion National Forest in late June. In the last half of 1964, populations became epidemic in parts of the upper Piedmont of North Carolina. Increasing beetle population on the Homochitto National Forest in Mississippi is indicated.

A few active infestations were found in Hardin County, Tex., in September. Beetle activity was found in the West Bay section of Louisiana in the spring, but declined in the fall. Small buildups occurred on the Talladega National Forest in Alabama but were promptly suppressed. On the Chattahoochee National Forest in Rabun County, Ga., populations remained at a low level until early fall when sharp increases occurred.

Black turpentine beetle, *Dendroctonus terebrans* (Oliv.). The black turpentine beetle remained active throughout the South and Southeast. In general, infestations were not severe except for increases in the rate of tree-killing in recently cutover areas in east Texas.

Ips (pine engravers) *Ips* spp. *Ips avulsus* Eichh. was active in the Piedmont of North Carolina, South Carolina, and Arkansas. In central Alabama and Georgia, populations rose in the spring but declined with the arrival of abundant summer rainfall. Other species of ips were also found, but, in general, losses were little, if any, greater than in previous years. These beetles have a record of sudden increases in population and equally sudden decreases. They are often associated with southern pine beetle and black turpentine beetle.

Balsam woolly aphid, *Chermes piceae* (Ratz). The balsam woolly aphid continued to cause extensive fir mortality in the vicinity of Mount Mitchell, N.C. New infestations were detected on Roan Mountain, Grandfather Mountain, and Mount Sterling and Cataloochee Mountain in the Great Smoky Mountains National Park. An additional infestation was detected in a Fraser fir plantation near Blowing Rock, N.C.

Infested trees in the Great Smoky Mountains National Park are being cut in an attempt to reduce the rate of spread of the aphid and to minimize fir mortality. Biological control by the release of aphid predators has been in progress since 1959, but so far the impact of predators on aphid populations is uncertain.

Elm spanworm, *Ennomos subsignarius* (Hbn.). The long-standing outbreak of elm spanworm collapsed in 1964 after extensively damaging the Southern Appalachian hardwood forests. Infertile eggs and an egg parasite, *Telenomus alsophilae* Vier., were responsible for collapse of the outbreak. Nearly 90 percent of the viable eggs were parasitized in 1964.

Pales weevil, *Hylobius pales* (Hbst.). The pales weevil and related species damaged pine seedlings in various parts of the Southern and Southeastern States. Relatively little damage occurred in areas that were prepared for planting prior to May 15, 1963, and were planted in January and February of 1964. However, up to 18 percent of the seedlings were damaged in similar sites that were prepared for planting between September and November 1963, and planted in January and February 1964. The amount of weevil damage in the latter sites was greatest in areas that had been cleared of a relatively heavy stand of small pine saplings.

Pales weevil continued to damage pine plantations on the Croatan National Forest and adjacent lands in eastern North Carolina. Damage was reported on the Bent Creek Seed Orchard near Murphy, N.C., and on understory white pine reproduction in the mountains of western North Carolina and northwestern South Carolina.

Pine sawflies, *Neodiprion* spp. The loblolly pine sawfly, *Neodiprion taedae linearis* (Ross), damaged approximately 679,200 acres in Arkansas and severely defoliated 2,500 acres in the vicinity of Georgetown and Urania, La. Populations were higher in Arkansas than at any time since the outbreak in 1946–47. Endemic populations of the redheaded sawfly, *N. lecontei* (Fitch), caused scattered damage in the north-central part of North Carolina.

Forest tent caterpillar, *Malacosoma disstria* (Hbn.). Defoliation by the forest tent caterpillar in Louisiana declined; noticeable defoliation occurred only in the vicinity of Krotz Springs. In Alabama, approximately 12,680 acres of tupelo gum were completely defoliated and 3,410 acres were fed upon in the Stockton-Fort Stoddard area.

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Fraser fir killed by the balsam woolly aphid in the Great Smoky Mountains National Park, N.C.

F–509843

Efforts are being made to prevent and control spread of balsam woolly aphid infestations in the Great Smoky Mountains National Park by felling infested trees.

Fall webworm, *Hyphantria cunea* (Drury). In 1964, webworms were again active in parts of Arkansas and seriously affected the esthetic value of the Pea Ridge National Military Park in the northwest corner of the State.

Miscellaneous insects. Heavy infestations of the Nantucket pine tip moth, *Rhyacionia frustrana* (Comst.), severely damaged high-value loblolly and shortleaf pine seed orchards and pine plantations in north Alabama during early fall. The locust leaf miner, *Xenochalepus dorsalis* (Thunb.), caused widespread damage to black locust in eastern Tennessee. The larger elm leaf beetle, *Monocesta coryli* (Say), defoliated elms in river bottoms in the Piedmont of North Carolina, South Carolina, and Alabama. The oak skeletonizer, *Bucculatrix ainsliella* Murt., damaged red oak in Hawkins County, Tenn. A coneworm, *Dioryctria clariorallis* (Wlk.), was exceptionally destructive to first-year longleaf pine cones in a seed production area in the Francis Marion National Forest, S.C. This and other cone and seed insects caused extensive damage in Florida as well as in other parts of the Southern and Southeastern States.

NORTHEASTERN STATES

By JAMES L. BEAN, Division of State and Private Forestry,
Upper Darby, Pa.

Conditions in Brief

Drought that has prevailed throughout the Northeast was cause for concern, especially in those areas where insect populations continued at a high level. Notable was the loss of tree growth in the valuable hardwood stands in Pennsylvania and New York from lack of moisture, and the heavy defoliation by the fall cankerworm and oak leaf rollers. The same conditions were reported in scale-infested beech-maple stands in Vermont, and in Maine where a possibly new species of leaf miner has caused extensive browning of oaks. Should these conditions continue in 1965, heavy top kill as well as tree mortality can be expected.

A potential threat to the native hemlocks in the Northeast has been recognized in the *Fiorinia* scale. Although currently restricted to

ornamental hemlock along the eastern shore, mortality of native hemlock from this scale is now evident in the vicinity of Philadelphia, Pa. Control of the scale under natural conditions is proving to be very difficult.

Aerial spraying of the spruce budworm in Maine in 1964 helped to reduce populations to where further control will not be necessary in 1965.

The red pine scale continued its slow spread in southern New York and southwestern Connecticut. All infested trees in New Jersey were cut and destroyed, this being the standard control procedure for the scale in the State. Increased activity by the forest tent caterpillar, hemlock looper, and the larch sawfly was reported from Maine. Elsewhere, populations of these pests declined.

Excellent control of several sawfly outbreaks in Pennsylvania, New Jersey, and New York was obtained from application of specific polyhedral viruses. Continued use of these biological agents for insect control is planned. In general, activities by the other major forest insect pests in the Northeast either declined or continued unchanged.

Status of Insects [1]

Spruce budworm, *Choristoneura fumiferana* (Clem.). Aerial spraying of 58,100 acres of spruce-fir in northern Aroostook County, Maine, was successfully completed in 1964. Larval populations were reduced by 96 percent.

A double treatment, each at the rate of one-half pound of DDT per acre, was applied over most of the control area. Around ponds and along streams and rivers, the first 100 feet from the shoreline was left unsprayed, and the next 100 feet received only a single treatment. Maine fish and game biologists observed no immediate effects on either fish or game. Field tests with malathion on the spruce budworm in northern Maine involved four different treatments. Control ranged from 50 to 70 percent. The concentrate (i.e., 95 percent technical malathion) applied directly, undiluted, at the rate of 1 pint (1.2 pounds) per acre showed the most promise of control (70 percent). Low budworm populations and a high incidence of egg and larval parasitism in Maine were instrumental in the decision not to spray in 1965.

A large number of spruce budworm moths were collected in a black-light trap near Dover, N.H., in July. Extensive surveys will be made in this area in 1965.

[1] Report compiled from information submitted by Northern and Southern Zone Entomologists and by State cooperators.

Gypsy moth, *Porthetria dispar* (L.). Variable defoliation by this forest insect was reported throughout the Northeast. Slight declines were noted in Maine, New Hampshire, Vermont, and Rhode Island, while defoliation increased in Connecticut, New York, New Jersey, and Pennsylvania. Limited control operations by States and ARS were carried out in Vermont, Rhode Island, Massachusetts, New York, and Pennsylvania. Tests with sevin were only partially successful.

Based on egg mass surveys, extensive defoliation is expected in 1965 in New York. Limited control operations may also be necessary in Rhode Island. The National Park Service is concerned about a gypsy moth infestation within the boundaries of the Cape Cod National Seashore area. If biological evaluations indicate a need for control in this area, the insecticide sevin may be recommended.

Forest tent caterpillar, *Malacosoma disstria* Hbn. During 1964, defoliation by this insect became more severe throughout northern Maine. Population increases are expected to continue in this area in 1965. Except for scattered increases in central Pennsylvania, a general decline was reported in the remaining States in the Northeast.

Fall cankerworm, *Alsophila pometaria* (Harr.) and other hardwood defoliators. A rapid buildup of the fall cankerworm during the past 2 years in northwestern Pennsylvania and western New York has resulted in extensive defoliation over thousands of acres of northern hardwoods. Accompanying the fall cankerworm, but playing a subordinate role, were the spring cankerworm, *Paleacrita vernata* (Peck), Bruce spanworm, *Operophtera bruceata* (Hulst), the linden looper, *Erannis tiliaria* (Harr.), and the elm spanworm, *Ennomos subsignarius* (Hbn.). Practically all species of hardwoods were attacked, with stands on ridgetops and side hills exhibiting the heaviest damage. The trend of this infestation and the need for suppression activities in 1965 are not presently known. Extensive egg mass surveys are being planned for early 1965.

Small scattered populations were also reported from New Jersey, western Virginia, and northern West Virginia. Defoliation in these areas was generally light, although along the eastern shore of New Jersey about 6,000 acres were heavily defoliated.

A looper, *Phigalia titea* (Cram.). Heavy defoliation of oaks and hickories by this looper continued in northwestern Virginia, chiefly on the George Washington National Forest. This is the third year of heavy defoliation in this area. Some top mortality is now evident. Continued defoliation and the current drought may cause a severe setback to tree growth.

This insect also was present in most stands defoliated by the fall cankerworm in east central Pennsylvania.

Hemlock looper, *Lambdina fiscellaria* (Guen.). An isolated stand of approximately 25 acres of hemlock in southwestern Maine was completely defoliated by the hemlock looper in 1964. Other associated tree species (white spruce, maple, oak, and shagbark hickory) were also defoliated. Aerial and ground surveys did not reveal other nearby areas of defoliation, although adult moths were common in September and October. Heavy pupal parasitism was reported. The small infestation in Rhode Island declined.

Larch sawfly, *Pristiphora erichsonii* (Htg.). Defoliation of larch by this insect increased throughout central and northeastern Maine. In one specific area defoliation averaged 27 percent in 1962, 50 percent in 1963, and 77 percent in 1964. In Acadia National Park on Mount Desert Island approximately 170 acres of larch were completely defoliated. Increasing sawfly populations ranging from light in some areas to heavy in others were observed in eastern New York and central Pennsylvania. Larch sawfly populations on the Monongahela National Forest in West Virginia were reported on the decline.

European pine sawfly, *Neodiprion sertifer* (Geoff.). Serious outbreaks of this sawfly were reported in central New York, northwestern and northeastern Pennsylvania, and northern New Jersey. It was found in northern New York, on Tug Hill, for the first time. Scotch pine appeared to incur the heaviest attacks. The infestation in northwestern Pennsylvania was reported as the most serious ever recorded. Control operations were carried out in all three States. In Pennsylvania, 40 acres of red, Austrian, and Scotch pines were aerially treated with 1¼ pounds of DDT dust per acre with excellent results. Ninety-five acres in Pennsylvania, 53 acres in New Jersey, and smaller acreages in New York were aerially sprayed with the polyhedral virus, also with excellent results. It is now apparent that control of this sawfly with specific viruses is economically feasible.

Red-headed pine sawfly, *Neodiprion lecontei* (Fitch). A general increase in populations of *N. lecontei* was observed in Vermont, Rhode Island, and New York. Most damage occurred in red pine plantations, although Pennsylvania reported 50 percent defoliation of a larch stand besides light to moderate defoliation of Scotch, mugho, and jack pines. Control measures were required in some plantations in Vermont and New York. Maryland regularly suppresses populations of this sawfly whenever they are located.

Virginia pine sawfly, *Neodiprion pratti pratti* (Dyar). A marked increase in populations of this sawfly was observed throughout the southern part of the Region, especially in eastern Virginia. Although defoliation was generally light to moderate, some areas of heavy defoliation were noted. Of special interest is the recovery in 1964 in Virginia of the pupal parasite *Dahlbominus fuscipennis* (Zett.) from sawfly cocoons collected in some of the areas where releases had been made in 1960 and 1961.

Oak leaf miner, *Profenusa* sp. A suspected new species of this genus of sawflies caused widespread browning of oak foliage in western Maine. Aerial surveys indicate that damage was more widespread in 1964 than in 1963. There was also evidence that defoliation by this insect and the general rainfall deficiency during the past several years will result in appreciable growth loss and top mortality. Studies of the life history, habits, and growth impact of this leaf miner are being carried out by the Maine Forest Service.

Oak leaf roller, *Croesia semipurpurana* (Kerf.). (*Argyrotoxa*). Two or more successive years of defoliation by this insect has resulted in the decline and mortality of red oak in many parts of Connecticut. Approximately 500,000 acres of oaks in Pennsylvania and 41,000 acres in New Jersey were heavily defoliated in 1964. This insect is thought to be the primary cause of oak mortality throughout these areas, with fungi and secondary insects contributing. Attacks by the two-lined chestnut borer, *Agrilus bilineatus* (Web.), have aided materially in the decline and death of affected trees. Suppression on 300 acres is being considered in New Jersey for 1965.

Miscellaneous defoliators. Severe browning by the birch leaf miner *Fenusa pusilla* (Lep.), were common throughout southern Maine, northwestern Vermont, and northern and eastern New York. Damage to birch was more severe from later sawfly generations than from early. Excellent control was obtained in New York with mistblower application of a 2-percent sevin-water solution applied at 2-week intervals from May 15 to July 1. Another leaf mining sawfly, *Profenusa thomsoni* (Konow), caused extensive browning of white birch throughout the Androscoggin Valley in Maine. This is the first record of this sawfly in Maine. Damage to white birch by the birch casebearer, *Coleophora salmani* (Hein.), was more noticeable in northeastern Maine in 1964, with an apparent increase in intensity and area over 1963. Browning of larch by the larch casebearer, *Coleophora laricella* (Hub.), was common in central Vermont.

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Larch twigs infested with parasitized larch casebearers were collected in Vermont and shipped to Montana where parasites were reared and released in larch casebearer infestations in Idaho and Montana. The collection of infested larch twigs was a cooperative program between the Forest Service and Vermont's Departments of Forests and Parks.

The four-species complex of arborvitae leaf miners decreased considerably in abundance throughout south-central Maine. Foliage recovery was good. A similarly rapid decrease in miner activity occurred about 10 years ago in the same general area.

Browning of pitch pine in central Massachusetts by the pine needle miner, *Exoteleia pinifoliella* (Chamb.), a continuation of the 1963 infestation, was very noticeable in 1964.

Defoliation by the fall webworm, *Hyphantria cunea* (Drury), continued throughout the Northeast, but gradually decreased in intensity. Scattered light defoliation by several species of pine sawflies, including *Neodiprion pratti paradoxicus* (Hein.), *N. pini-rigidae* (Nort.), *N. pinetum* (Nort.), and *Diprion similis* (Htg.), was observed in New Jersey.

The extensive 1963 New Jersey outbreak of the orange-striped oakworm, *Anisota senatoria* (J. E. Smith), declined considerably in 1964, although heavy defoliation did recur on several hundred acres in Ocean County. A disease-causing protozoan was recovered from the oakworm and is now being identified.

European pine shoot moth, *Rhyacionia buoliana* (Schiff.). Damage by this pest to red pine continued to be a serious problem in most of the Northeast. Population increases were most evident in southern Maine, eastern Pennsylvania, and central New Jersey. In other previously infested areas most populations reported minor decreases.

Pine tip moth complex, *Rhyacionia frustrana* (Comst.) and *R. rigidana* (Fern.). Populations of these insects continued at light-moderate damage levels over most of their known range in southern New Jersey, eastern Pennsylvania, Virginia, and West Virginia. On the Piedmont of Virginia, injury continues to increase. Damage was most evident on seedlings and saplings.

White-pine weevil, *Pissodes strobi* (Peck). Population levels of this weevil remained unchanged or declined somewhat in 1964. The lack of snow cover for the overwintering adults aided in the decline in Maine and New Hampshire. Localized increases, however, caused some concern to plantation owners in southwest Maine, central New Hampshire, and southern New York. Control was limited to ground treatments in New York and Pennsylvania. In a special test with a helicopter in May on the Massabesic Experimental Forest, Maine, DDT was applied twice at the rate of 1 pound per acre per application and gave encouraging results. This test was part of a white pine management experiment.

Red pine scale, *Matsucoccus resinosae* B. & G. This potentially important pest of red pine continued its slow spread during 1964. During the past 5 years the scale has spread an estimated 5 miles in an east-west direction. The northward spread was considerably less. The current known distribution of the scale extends from southwestern New Haven and southern Fairfield Counties, Conn., southward and westward through the southern half of Westchester County, N.Y. Known infestations in New Jersey have been cut out, and the infested trees destroyed whenever located.

Of special importance is the recently reported infestation on 35 ornamental Japanese black pine (*Pinus thunbergii*) in Roslyn, N.Y. Extensive plantings of this species of pine have been made along the seacoast and in other areas as a substitute for red pine and because of its supposed resistance to the red pine scale. It is possible that this pine may now be a major host of the scale. Surveys are planned for 1965 to determine more accurately the current distribution of the red pine scale.

Hemlock scale, *Fiorinia externa* Ferris. This scale species is a serious threat to native and ornamental hemlocks throughout the Northeast. Currently, scale infestations are restricted to ornamental hemlocks along the eastern seaboard from southern Westchester County, N.Y., to Baltimore, Md. However, heavy mortality of scale-infested native hemlocks is now evident in the Wissahickon Valley Park section of Philadelphia, Pa. So far, control of the scale under natural conditions has been unsuccessful, although hydraulic applications of Cygon on ornamental plantings have given a high degree of

control. This scale is considered a major insect problem in this region.

Beech scale-nectria complex, *Cryptococcus fagi* (Baer.) and *Nectria coccinea* var. *faginata.* This scale-disease complex continues to be a serious problem in growing high-quality beech wherever the two organisms occur together. In western Maine, infestations of the scale increased materially during 1964, but nectria infections did not. In New Hampshire, scale-nectria infestations, with scattered exceptions, remained static. The heavy scale infestation in Monroe County, Pa., continued without the presence of the nectria fungus. Control measures were undertaken against the Pennsylvania infestation in September 1964, with tests of a DDT-malathion mixture and a lindane solution. Application was by a truck-mounted hydraulic sprayer. Preliminary examinations indicated good results with both spray materials.

Balsam woolly aphid, *Chermes piceae* (Ratz.). A general decrease in aphid populations and damage to balsam fir was noted throughout the Northeast, while the infestations on Fraser fir in the Shenandoah National Park, Va., remained unchanged. Of special importance is the continuing northward movement of the aphid in Maine. Infested balsam firs have been observed in the Bancroft area just south of Houlton in Aroostook County. Active populations of the European predator, *Laricobius erichsonii* Rosenh., may be found in most of its release areas.

Pine leaf aphid, *Pineus pinifoliae* (Fitch). Populations of the pine leaf aphid remained at a low level in Maine, New Hampshire, and Vermont, but continued to increase in New York. In areas where the infestation had declined, trees growing on poor sites that were heavily damaged in 1963 were in very poor condition in 1964. In contrast, those pines growing on the better sites have shown good recovery. In New York where damage was the heaviest, all size and age classes of white pine were attacked, especially those stands contiguous to red and black spruce.

Southern pine beetle, *Dendroctonus frontalis* Zimm. After a slight decline in 1963, the southern pine beetle regained its status as the major insect problem on the Piedmont of Virginia. Beetle activity increased considerably in 1964. Associated *Ips* and black turpentine beetle activity was not as severe as in 1963. Salvage of beetle-killed pines has been undertaken in most infested areas.

Miscellaneous insects. Numerous reports on minor forest insects were received in 1964. This is a tribute to the interest in surveillance taken by the many cooperators in the Northeast. Most of these insects, however, were of relatively little importance, except the following species that caused noticeable but localized damage. The white-pine shoot borer, *Eucosma gloriola* (Perg.), is becoming a serious plantation problem in Pennsylvania. In some white pine plantings where the white pine weevil has been effectively controlled, *Eucosma* has caused as much damage as the weevil did previously.

A pit-making bark scale, *Asterolecanium minus* Lind., continued to be a factor in oak decline in parts of Pennsylvania and West Virginia. Drought in Vermont was believed to be instrumental in an *Ips pini* (Say) outbreak that has caused some tree mortality in a plantation of pole-size red pine.

Aerial and ground surveys have located heavy infestations of the oystershell scale, *Lepidosaphes ulmi* (L.), and of *Xylococculus betulae* (Perg.) on beech throughout most of southern Vermont. Damage by these scales has undoubtedly been aggravated by the prolonged drought conditions. Heavy infestations of both Tetranychid and Eriophyid mites principally on red oaks and other hardwoods have caused serious concern in Vermont, especially where these mites are associated with scale insects.

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Ventral view of hemlock twig showing hemlock scale on needles. Dark spots are adult female scales. White spots are waxy secretions of the crawlers. (Photo courtesy of the Entomology Department, University of Maryland.)

Hard maple logs stored at mill sites in Vermont have become infested with a species of Ambrosia beetle and its associated fungi. Numerous Christmas tree growers in the Northeast have reported increased aphid populations following fertilization of their trees. The problem here is the discoloration due to the formation of sooty mold.

ALASKA

By DAVID CROSBY, Division of Administrative Management,
Juneau, Alaska

Conditions in Brief

The forest insect situation in Alaska became increasingly critical with the continued buildup of black-headed budworm and hemlock sawfly populations. On the other hand, bark beetles were very scarce except for the relatively unimportant cedar bark beetle. Hardwood defoliators and sucking insects occurred only in endemic numbers.

Status of Insects

Black-headed budworm, *Acleris variana* (Fern.). This species, Alaska's most important forest insect pest, showed a marked increase in activity, particularly in that part of southeast Alaska north of Frederick Sound. However, populations were abundant on the northern half of Prince of Wales Island, including the nearby islands on the west side, where budworm is also considered in epidemic status. In addition to the areas infested near Juneau, Sitka, and southern Admiralty Island, the Lynn Canal and Haines areas were also hit hard during the past season. The increase in budworm activity in southeast Alaska in recent years is illustrated in terms of total acreage of browned areas delineated by aerial surveys, as follows:

1962—1,400 acres
1963—8,000 acres
1964—48,260 acres

The trend of infestations is expected to be upward. Only one parasite, *Phaeogenes arcticus* (Cush.), was recovered in significant numbers. It, along with possible adverse weather conditions, may be the only check on the development of the budworm in 1965. Egg counts on trees felled in October and November throughout the areas of pronounced tree browning showed generally high egg populations. This portends continued epidemic conditions in 1965.

Hemlock sawfly, *Neodiprion tsugae* Midd. There was a marked increase in hemlock sawfly activity in 1964. While the highest concentration of infestations was found in the Kasaan Bay area on Prince of Wales Island, the overall picture is one of generally higher populations to the north of Frederick Sound than to the south. Sawfly eggs were not recovered in appreciable numbers in the fall black-headed budworm egg survey. However, because of generally favorable weather during the egg-laying period in late summer, it is expected that the current buildup of the sawfly will continue in 1965.

Sitka spruce beetle, *Dendroctonus obesus* (Mann.), (*D. borealis* Hopk.). The sitka spruce beetle occurred only in low endemic numbers. Highway and aerial observations from Kodiak Island to Anchorage, Fairbanks, and the Copper River Valley revealed only a few yellow or red-topped trees. Recent spot kills on the Kenai Peninsula and on one or two sections of land near Haines were almost completely inactive.

Cedar bark beetle, *Phloeosinus squamosus* Blkm. The cedar bark beetle continued active over much of southeast Alaska, but the rather considerable tree killing was confined to stands of Alaska cedar of low commercial value.

Ips (pine engraver), *Ips* spp. The ips beetles were at very low population levels throughout Alaska. An aerial reconnaissance of the Sheenjek and Chandalar River areas north of Fort Yukon, to sites of ips beetle outbreaks in the late fifties, failed to reveal current beetle activity.

Unidentified malady of white spruce and mountain hemlock. Unexplained discolorations of white spruce and mountain hemlock with accompanying losses of needles occurred on several hundred acres of white spruce at Mount McKinley National Park and on adjacent areas in the Kenai Peninsula in 1963. The problem area on the Park was reexamined and the causal agent identified as a spruce needle rust *Chrysomyxa ledicola* (Pk.) Lagerh. This or similar rusts were very common in western Alaska in 1964. The malady on mountain hemlock remained on the Kenai Peninsula but was much less severe than during prior seasons. The causative agent remained unidentified.

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